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INDUSTRIAL LOCATION AND TRADE IN ONTARIO

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MAY, 1982

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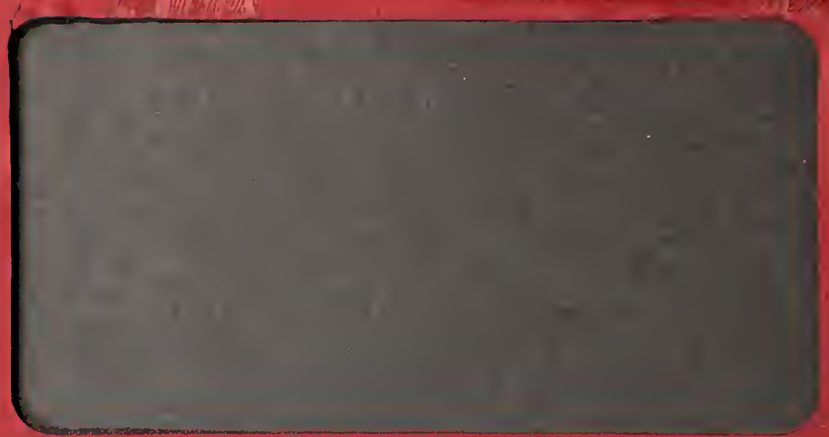
Toronto, Ontario



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CHAPTER ONE

Governments at all levels are under continuous pressure to solve problems arising from regional disparities. The introduction of new industry is seen as a means of achieving both equality and self-sufficiency within regions. In the public forum much attention has been given to the idea of extending the level of resource-processing or of increasing the volume of end-products produced in the more remote regions. To the extent that such a policy might involve an increase in the prosperity of one region at the expense of another, it becomes a political question for which this project offers no guidance. On the other hand, through an increased understanding of how the economy of Ontario functions it is easier to distinguish policies which are feasible and plausible from those which are not. This study is concerned with the feasibility and plausibility of industrial relocation as a device for solving the problems of regional disparity. It considers the policy implications of two theories which account for the specialization of industries in regions and for the location distribution of production among them. These theories, the Heckscher-Ohlin Theorem and the Central Place Theory, are briefly described below.

Theoretical Background

The Heckscher-Ohlin Theorem is based on the assumption that there are immobile resources spread out unevenly over space. Regions therefore differ in their endowments of resources - some will have proportionately more forested land, iron ore, etc., than others. Commodities also differ in the proportions in which resources are required in production; therefore some will be more suitable than others for production in a particular region. If the ratio of arable land in one region to arable land in the rest of the world is greater than the same ratio for labour, that region is considered land abundant; an ordering of such ratios may be used to characterize the endowment of regions (Vanek, 1969). Commodities are classified according to their resource intensiveness. The intensiveness of a commodity in land relative to labour is in direct proportion to the ratio required in its production. The earliest stages of processing are established at the resource site, and become the basis for attracting later stages of processing which are intensive in commodities produced at the

earlier stages. If the Theorem is correct, the location of forests, for example, determines the location of logging, which determines the location of saw-mills, which in turn determines the location of furniture manufacturers. A region abundant in forested acreage would specialize in and export such commodities.

On the basis of Central Place Theory, it is postulated that the growth of cities and the location of production is a simultaneous process: profit opportunities bring a maximum number of firms into each area. The market size for each product can be determined by the number of customers necessary for the firm to operate at its optimal level of output. Firms become located over space in a manner that leaves each the market size necessary for it to operate at zero economic profit under conditions of monopolistic competition. Firms with the smallest market requirements will have the smallest market areas. Some of the points where such production occurs are also points where firms requiring larger markets are located, and some of these latter will be locations for firms requiring even larger markets. This is the basis for regularities between city size and number of functions; the firms having the largest market requirements would locate in the largest cities. Self-sufficient regions would emerge naturally and trade would arise only if the boundaries of these regions crossed politically defined boundaries (Lösch, 1954).

This is not to suggest that, in the real world, one expects to observe this pattern exactly. In practice, firms do not necessarily optimize; there is human error. Furthermore, physical barriers and historical accidents may play a significant role in accounting for location. Some systematic influences operate in favour of cities of larger sizes: all producers in the larger cities benefit from the existing infrastructure, which can be provided without excessive taxation because the costs are spread over a larger number of taxable units. Producers located in cities also benefit from the agglomeration economies such as available supplies of specialized labour, specialized suppliers, research institutions, and market organizations. The pure theory of Central Place contributes to our knowledge of regional economics by demonstrating that, even if resources and people were at one time distributed evenly over a featureless plain, cities and towns of various sizes would eventually emerge as a consequence of each firm wishing to minimize the cost of transportation within its market area, and of consumers wanting to minimize the cost of travel to the market.

The economic conditions which it describes cause people and production to become collected in cities and towns, and this is an independent force which must be considered, in addition to resources, as explaining the location of production and trade, particularly if the size of a city brings about economies associated with agglomeration. The latter occurrence then becomes an induced source of comparative advantage.

Both theories are especially important policy considerations for Canada. Many of Canada's regions are dominated by production of non-renewable resources; regions with production based on resource abundance are likely to be highly specialized in the manner dictated by the Heckscher-Ohlin Theorem, producing commodities intensive in abundant resources processed up to the earliest stage, and exporting these to many other regions in exchange for intermediate and final goods. A second feature influencing the industrial character of Canadian regions is the extensive border with the United States; most Canadians live within 100 miles of this border, which intersects the boundaries of natural regions defined by Central Place Theory.

Empirical formulation

It is not the objective of this study to empirically test either the Hecksher-Ohlin Theorem or Central Place Theory, and it is not assumed that either of these theories hold in exact mathematical form. It is assumed, however, that the two together can explain the distribution of production and trade in Ontario's regions. This is the rationale for Chapter Three, where we establish the hypothesis, with regard to each of 110 industries, that the percentage employment by county can be predicted from four types of variables relating to (1) the presence or absence of resources, (2) the population of the largest city in the county, (3) county density, and (4) the locations of industrial suppliers or buyers. The rationale for an exact form of this hypothesis and the statistical method used are described in Chapter Two. It is found that the percentage employment by county can be well predicted from these four types of variables and, as a consequence, it is possible to identify the broad classes of commodities which are most suitable for a given region.

It is intended that this project should be comprehensive in coverage since it takes under review 110 industries, 54 counties and nine regions.

Accordingly, it is not possible to investigate cost variables which explain behaviour at the level of the individual firm or enterprise. To do this for all Ontario firms would constitute a task beyond the financial resources of even the largest research institutions. It is hoped that this and perhaps other studies of this type can be used to identify a select number of industries where microeconomic research would show fruitful results.

Empirical results

The results of the industrial analysis are summarized in the table at the end of this chapter, and presented in much more detail again in Chapter Three. Table 1.1 in this chapter lists the name of each industry and the Standard Industrial Classification number in the left-hand column. In the next column there is an indication of the best results obtained from the empirical research. If the percentage of employment is determined solely by city size and county density variables the word "city" appears. If location is determined only by the proximity to resource, or to industrial suppliers or buyers, the word "technological" appears. If both types of variable have significant influence the word "both" appears, and if neither, the word "neither" appears. In order for the reader to compare the best empirical results of the regression in which percentage employment in one industry serves as dependent variable, to those in which another is dependent, the squared multiple correlation coefficient appears in the far right column. This is a measure of the percentage of variance explained by the independent variables. The value of the multiple correlation coefficient rises with the number of variables in the regression and, since some of the regressions in Table 1.1 require more variables than others, the value of the multiple correlation coefficient for one is not comparable to another unless corrected for "degree of freedom". This correction has been made. Table 3.1 of Chapter Three summarizes the success of this part of the project.

Regional characteristics - production and trade

According to the Heckscher-Ohlin Theorem, each region should be specialized in production in commodities which require relatively more of the region's most abundant resources, and these would constitute its

TABLE 1.1
Statistically significant factors affecting location of 110 industries

S.I.C.	Name of Industry	Type of Variable	RSQ*	S.I.C.	Name of Industry	Type of Variable	RSQ*
101	Meat & Poultry Products Industries	city	.79	252	Veneer and Plywood Mills	technological	.51
102	Fish Products Industry	technological	.60	254	Sash, Door and Other Millwork Plants	both	.94
103	Fruit and Vegetable Processing Industries	technological	.45	256	Wooden Box Factories	city	.32
104	Dairy Products Industry	both	.89	258	Coffin and Caskets Industry	city	.79
105	Flour and Breakfast Cereal Products Industry	technological	.37	259	Miscellaneous Wood Industries	both	.53
106	Feed Industry	both	.58	261	Household Furniture Manufacturers	city	.85
107	Bakery Products Industries	both	.98	264	Office Furniture Manufacturers	technological	.41
108	Miscellaneous Food Industries	both	.97	266	Miscellaneous Furniture and Fixtures Manufacturers	both	.99
109	Beverage Industries	both	.92	268	Electric Lamp and Shade Manufacturers	both	.996
151	Leaf Tobacco Processors	neither	.07	271	Pulp and Paper Mills	both	.75
153	Tobacco Products Manufacturers	city	.65	272	Asphalt Roofing Manufacturers	technological	.56
162	Rubber Products Industries	both	.72	273	Paper Box and Bag Manufacturers	city	.95
165	Plastics Fabricating Industries, n.e.s.	both	.94	274	Miscellaneous Paper Converters	city	.97
172	Leather Tanneries	city	.61	286	Commercial Printing	technological	.98
174	Shoe Factories	city	.49	287	Platemaking, Typsetting and Trade Bindery Industry	both	.998
175	Leather Glove Factories	neither	.15	288	Publishing Only	city	.995
179	Luggage, Handbag and Small Leather Goods	both	.94	289	Publishing and Printing	both	.997

181	Cotton Yarn and Cloth Mills	neither	.27	291	Iron and Steel Mills	both	.53
182	Wool Yarn and Cloth Mills	both	.56	292	Steel Pipe and Tube Mills	neither	.12
183	Man-made Fibre, Yarn and Cloth Mills	neither	-.05	294	Iron Foundries	technological	.71
184	Cordage and Twine Industry	neither	.02	295	Smelting and Refining	technological	.80
185	Felt and Fibre Processing Mills	both	.84	297	Copper and Copper Alloy Rolling, Casting and Extruding	city	.92
186	Carpet, Mat and Rug Industry	city	.54	298	Metal Rolling, Casting & Extruding	city	.86
187	Canvas Products, and Cotton and Jute Bags Industries	city	.98	301	Boiler and Plate Works Appliances	both	.31
188	Automobile Fabric Accessories Industry	both	.71	302	Fabricated Structural Metal Industry	both	.96
189	Miscellaneous Textile Industries	technological	.97	303	Ornamental and Architectural Metal Industry	city	.98
231	Hosiery Mills	city	.78	304	Metal Stamping, Pressing and Coating Industry	both	.96
239	Knitting Mills (except Hosiery Mills)	technological	.75	305	Wire and Wire Products Manufacturers	both	.82
234	Men's Clothing Industries	technological	.94	306	Hardware, Tool and Cutlery Manufacturers	both	.82
244	Women's Clothing Industries	city	.990	307	Heating Equipment Manufacturers	city	.95
245	Children's Clothing Industry	both	.96	308	Machine Shops	both	.99
246	Fur Goods Industry	both	.998	309	Miscellaneous Metal Fabricating Industries	both	.90
248	Foundation Garment Industry	city	.87	311	Agricultural Implement Industry	technological	.51
249	Miscellaneous Clothing Industries	city	.91	315	Miscellaneous Machinery & Equipment Manufacturers	both	.92
251	Sawmills, Planing Mills and Shingle Mills	technological	.41	316	Refrigeration and Air Conditioning Equipment	neither	.21

TABLE 1.1
Statistically significant factors affecting location of 110 industries (continued)

S.I.C.	Name of Industry	Type of Variable	RSQ[A]
318	Office and Store Machinery Manufacturers	both	.23
321	Aircraft and Aircraft Parts Manufacturers	both	.996
323, 325	Motor Vehicles, Parts & Accessories	city	.40
324	Truck Body & Trailer Manufacturers	city	.66
326	Railroad Rolling Stock Industry	city	.34
327	Shipbuilding and Repair	neither	.17
328	Boatbuilding and Repair	city	.44
329	Miscellaneous Vehicle Manufacturers	city	.74
331	Manufacturers of Small Electrical Appliances	technological	.89
332	Manufacturers of Major Appliances	both	.67
333	Manufacturers of Lighting Fixtures	both	.93
334	Household Radio and Television Receivers	both	.80
335	Communications Equipment Manufacturers	both	.83
336	Manufacturers of Electrical Industrial Equipment	technological	.73
338	Manufacturers of Electric Wire and Cable	city	.80
339	Manufacturers of Miscellaneous Electrical Products	both	.96
351	Clay Products Manufacturers	both	.54
379	Miscellaneous Chemical Industries	technological	.95
391	Scientific and Professional Equipment Industries	city	.95
392	Jewellery and Silverware Industry	city	.99
393	Sporting Goods and Toy Industries	city	.96
397	Signs and Displays Industry	city	.99
399	Miscellaneous Manufacturing Industries	both	.96

352	Cement Manufacturers	neither	.27
353	Stone Products Manufacturers	city	.72
354	Concrete Products Manufacturers	both	.94
355	Ready-Mix Concrete Manufacturers	technological	.93
356	Glass & Glass Products Manufacturers	both	.78
357	Abrasives Manufacturers	neither	.03
358	Lime Manufacturers	neither	.01
359	Miscellaneous Non-Metallic Mineral Products Industries	city	.63
365	Petroleum Refineries	city	.55
369	Miscellaneous Petroleum and Coal Products Industries	both	.79
372	Manufacturers of Mixed Fertilizers	technological	.71
373	Manufacturers of Plastics and Synthetic Resins	technological	.69
374	Manufacturers of Pharmaceuticals and Medicines	city	.69
375	Paint and Varnish Manufacturers	both	.99
376	Manufacturers of Soap and Cleaning Compounds	both	.91
377	Manufacturers of Toilet Preparations	both	.96
378	Manufacturers of Industrial Chemicals	neither	.04

exports. In its strict mathematical form, Central Place Theory explains the exact location on the plane of each kind of production; self-sufficient regions are formed but are crossed by politically defined boundaries, and trade arises as a consequence. In either theory, production in a politically defined region will differ from consumption. Production will determine trade if it is assumed that each region is similar in its consumption but differently specialized in production. According to the hypothesis, the production specialization of each region can be predicted knowing the four types of variable described in the previous section. In Chapter Four, regions are defined in terms of counties, and the characteristics of each region are discussed in terms of the four types of variable described in the section above. As a further test of the hypothesis that regional specialization and trade are explained by Heckscher-Ohlin and Central Place type variables, actual exports by region are compared to those predicted from the regional characteristics.

The objective of the analysis in Chapter Three is to set guidelines for future policy. The results demonstrate that in most industries percentage employment in a particular industry is well explained by the variables listed above, which also describe each region. The task for policy formulation is to predict on the basis of a region's characteristics which industries are most likely to be successful. A list of potential growth industries can be obtained by comparing the statistically determined characteristic of each industry to the characteristics of the region concerned. Furthermore, insofar as the results obtained from the county level industrial data in Chapter Three succeed, they are used in Chapter Four to explain specialization and trade in the regions, thus providing a better understanding of comparative advantage in each. There is a description in Chapter Four of each of the regions in terms of its resources, present industries, and population densities. The statistical results from Chapter Three pertaining to industries are then applied to each region.

Conclusion

In 94 cases out of 110 the regressions of the type described above are statistically significant, in 4 cases borderline, and in 12 cases not significant. A considerable percentage of the variance by location is explained: in 44 cases out of 110, over 90 per cent is explained; in 56

cases over 80 per cent is explained. Finally, it is found that city size and county density variables explain location more frequently than other Hecksher-Ohlin type variables (32 cases vs. 20).

It is concluded that the Central Place Theory variables explain a large portion of employment in manufacturing in Ontario, and that the growth of the manufacturing sector and large cities in Southern Ontario is a mutually reinforcing and simultaneous process likely to expand with freer trade. Policies which attempt to disperse the concentration of population work against that part of the manufacturing sector which benefits from a location at the centre of the population mass. These industries are identified in Chapter Three. Since they are also the ones which benefit most from economies of agglomeration and scale, their location in the province of Ontario reduces production costs and increases output per man.

On the other hand, there is a subset of industries which demonstrates statistically significant backward or forward linkages. In this case, technological linkages have also become locational linkages. These industries are identified in Chapter Three, and discussed in connection with the regions of Ontario in Chapter Four. In so far as the technological linkages lead backward to Ontario's resource base, they represent the influence of the Heckscher-Ohlin Theorem, and offer the best prospect for development in areas of lesser density. There is scope for development in the north through technological linkages, but this objective must be pursued with due regard for the comparative advantage of the south. The empirical results in this study are consistent with the hypothesis that free trade with the United States would give Ontario a greater number of end-product industries, and encourage production related to economies of agglomeration and scale.

CHAPTER TWO

METHODOLOGY

This study is an empirical adaptation of variables whose importance is established by the Heckscher-Ohlin Theorem and by Central Place Theory. The former has existed as part of the economics literature and the latter as part of the geographical literature for nearly half a century.

The Heckscher-Ohlin Theorem

It is assumed that regions differ in the amounts of resources available. The measure of resource abundance in the case of any resource k is the ratio of the regional supply of k to that of the rest of the world (Vanek, 1969). The set of all such ratios characterizes the regional endowment. Each commodity is characterized by its use of resources; the intensiveness of a commodity in resource k is measured as the amount of k required to produce a unit of output. If resource k is abundant in the region, there will be a positive correlation between the net amount of a commodity j exported and its intensiveness in resource k (Williams, 1977). This result derives from the fact that a region abundant in resource k becomes specialized in production of commodities intensive in it, but consumption of each commodity per dollar of national income in each region is similar to every other. The excess of production over consumption must be exported. Thus, according to the Heckscher-Ohlin Theorem exported commodities are intensive in abundant resources and sold in exchange for commodities intensive in resources which are scarce locally.

The Theorem has been increasingly refined over time by economists interested in producing a mathematically pure form. For this purpose, the following assumptions are usually adopted:

1) Commodities must be produced under constant returns to scale. This assumption is phrased more precisely by the statement that goods are produced from homothetic production functions.

2) Tastes in the home region and the rest of the world must be similar. This can be made rigorous in a number of ways (Johnson, 1969, 334). It can be assumed, for example, that individuals at the same level of income have identical preferences and that the common preference system is homothetic.

3) It must be possible to define commodity intensities independently of prices of resources. If one commodity is more intensive than another at one set of factor prices it must be so at all factor price ratios. One usually refers to this assumption by stating that there are no "factor-intensive reversals".

4) The resource endowment of the region is assumed to be fixed so that the factor abundance of one region relative to another does not change. That is, the factors of production must be fixed in supply, inter-regionally immobile, and physically identical.

5) Product prices are assumed to be equalized through free trade. This is achieved with further assumptions. There is perfect competition in product and factor markets, perfect mobility of resources within each region, and no tariffs or transportation costs.

6) The number of products produced must be at least as large as the number of resources, and the region must exchange with the rest of the world at least as many commodities as there are resources.

Unlike this present study, the Heckscher-Ohlin Theorem and the empirical tests of its have been formulated under circumstances where space can be ignored. Under such conditions the links between the stages of processing can be circumvented. This is usually accomplished in a Leontief framework which may be described as follows: assume that each industry produces a single commodity i, and let

a_{ij} = amount of commodity i required to produce commodity j
b_{kj} = amount of resource k required to produce commodity j
f_j = consumption of commodity j
e_i = export of commodity i
m_i = import of commodity i
v_k = fixed supply of resource k.

Furthermore, let I be the identity matrix, A a matrix with elements a_{ij}, B a matrix with elements b_{kj}, e a vector with components e_i, m a vector with components m_i, and v_o a vector with components v_k. Then we can compute $v_e = B(I-A)^{-1}e$, which is a vector whose typical component is the amount of resource k needed to produce exports, and $v_m = B(I-A)^{-1}m$, which is the amount of resource k needed to produce import replacements. The empirical research related to the Heckscher-Ohlin Theorem is almost

entirely confined to comparisons of resource supplies (the v_o) to the resource requirements of commodity imports and exports (the v_e and v_m). The jth column of the matrix A represents the intermediate goods required as direct input. In the Leontief empirical approach such costs play only an indirect input. Computations are obtained using the matrix $B(I-A)^{-1}$, which is called the direct plus indirect requirements matrix because an element in row k column j is the amount of resource k needed to produce one unit of commodity j taking into account the total cost of resources required to produce all intermediate goods involved directly or indirectly.

This empirical approach has two limitations which reduce its value for purposes of policy formulation. Firstly, it says nothing about commodities as such[1] and secondly, it implicitly assumes that regions are extremely small, with all production located near a single point, and yet large enough to produce some of every commodity. With space explicitly involved the matrix $B(I-A)^{-1}$ is not used. Director purchases of industry j from every other (represented by the elements of the j^{th} column of matrix A) must be considered, and resources (represented by the j^{th} column of the matrix B) will affect output through a series of backward linkages, under the hypothesis that firms locate near their source of supply. This was discussed and illustrated in Chapter One.

Linkage as a factor determining location

Within a spatial context the resource linkage may be either forward or backward. Clothing is usually produced in larger cities near the market and we may find that knitting mills are nearby to provide the necessary cloth. They would be forward linked to clothing production.

Either backward or forward linkage or both may play a significant role in determining the location of an industry, but a backward linkage between any two does not imply that a forward linkage will also exist; nor would a forward linkage imply the existence of a backward linkage. The presence of metal stamping may be a statistically significant backward

1 See, however, Baldwin (1971), Harkness (1978) and Harkness (1979). Melvin (1968) has shown that, when the number of commodities is greater than the number of resources, the Heckscher-Ohlin Theorem cannot determine commodity trade. The Theorem is limited to predictions of the cost of quantity of each resource needed to produce the total of all exported commodities less an allowance for resources arriving as part of the cost of all imported commodities.

linkage for the electric appliance industry if the electric appliance industry uses a large percentage of its cost to make such purchases. It does not follow, however, that a large percentage of sales to the metal stamping industry are delivered to the electric appliance users. Similarly, it may be found that a significant percentage of the sales of the knitting industry are sold to the clothing industry, but the purchase of the clothing industry are quite diverse and, therefore, knitting is not a statistically significant linkage.

The Heckscher-Ohlin Theorem is not formulated to produce predictions concerning the stage of processing at which resources will be exported. Under cost minimizing assumptions it is expected that the level of processing will depend on the weight lost through processing, on the presence or absence of complementary resource and energy, on the average and marginal cost of transport and on the cost of shipping at earlier stages relative to later stages. Unfortunately, such detailed data are not available.

It is possible to set up an empirical hypothesis, however, which may hold in the case of some groups of industries. Regions with production based on resource abundance are likely to be highly specialized in the manner dictated by the Heckscher-Ohlin Theorem, producing commodities intensive in abundant resources processed up to the earliest stage, and exporting these to many other regions in exchange for the intermediate and final goods.

Under this hypothesis, the larger places located farther away from supplies of resources will produce the greatest variety of goods and specialize at the late intermediate and end stages of processing because they are nearer to the centre of population. Because a greater number and variety of firms, both large and small, locate in large places, firms producing intermediate goods at the later stages of processing will also tend to locate in larger towns and cities for two reasons. Firstly, the weight losses through processing are diminishing as goods pass to later stages of manufacture, and consequently the prospects for reducing transportation costs by locating near resource supplies are of less importance. Secondly, as we proceed to high levels of processing, goods increase in volume and complexity. Consequently, the cost of shipping begins to rise per dollar of value, and firms minimize transportation costs by locating near the area of population density, and near other firms at later stages of processing. Location near resource supplies and near firms at early stages of processing becomes less attractive.

In this study, with space explicitly present, the links between each stage are subject to statistical hypotheses. To set up such hypotheses, the Canadian input-output table was arranged according to the 187 industry by industry format defined by the Statistics Canada input-output table. These data were used to calculate matrices A and B. A correspondence was then established between these 187 and the 110 industries, as defined by the Standard Industrial Classification, selected for regression study.

Candidates as backward linkages for a particular industry were defined as those suppliers whose shipments constituted over ten per cent of total purchases or, if no such suppliers existed, the supplier providing the largest percentage. If industry i is a principal supplier to industry j, then the percentage of industry i employment in county h would be one of the independent variables explaining y_{hi} (the percentage of industry i employment in county h).

Similarly, in the case of forward linkages, the candidates as locational factors for a given industry were those purchasers taking more than ten per cent of sales or, if none did, the single purchaser taking the greatest percentage. This can be expressed in the regression relationship,

$$y_{hi} = \sum_{r=10}^{n} \gamma_{hr} x_{hr} + \beta_{ho} \qquad (h=1,.....,110) \qquad (1)$$

where x_{hr} is the percentage of industry r employment in county h and γ_{hr} and β_{ho} are constants. The industries r are either principal suppliers to or buyers from industry i.

Central Place Theory

In constrast with the Heckscher-Ohlin Theorem, Central Place Theory is derived under the assumption that resources are spread evenly over space and that monopolistic competition (rather than perfect competition) prevails everywhere (Lösch, 1954). Whereas the Heckscher-Ohlin Theorem cannot explain commodity trade when the number of commodities exceeds the number of resources, Central Place Theory predicts the exact location of every kind of production. As explained in the first chapter, firms producing identical products are evenly spread over space. Those firms

whose products require the smallest market areas would be found most frequently in any region. Some of the points where small firms produce would also be locations for larger firms; some of these locations would be points of production for still larger firms. Only a few large cities would be locations for all types of production.

This does not imply that under actual conditions we expect that the relationships derived from the theory will hold precisely. In Lösch's version (1954), the location of each type of production and its market size would be determined by the number of customers it could serve when operating at zero profit. Therefore any firm which deviated from the optimal location would not be able to continue operation, in the long run, at any other point. Recently, Eaton and Lipsey (1976) have re-examined this assumption and have shown that the alternative assumption - that firms must earn non-negative profits - does not necessarily produce an equilibrium in which profits are zero; thus deviation from the optimum location point would not cause the firms to close down in the long run, but it would violate the assumption that firms maximize profits. In practice, it is expected that others of the factors described in Chapter One would play some role, particularly those systematic factors associated with agglomeration which operate in favour of larger cities. Therefore, the larger cities which develop through the mechanism of Central Place Theory would also become the location of production related to agglomeration.

In Central Place Theory, population density and the concentration of production are simultaneously determined: there is no causative relationship between them. It cannot be said either that manufacturing causes population density or that population density causes manufacturing. The two are related and each is necessary for the other. On the other hand, in policy decisions relating to particular industries the distribution of population density may be taken as constant or assumed to increase with the introduction of new industries. The task of policy-related empirical research is to describe the association between density of population and location of manufacturing.

Empirical Variables Related to Central Place Theory

Central Place independent variables are the logarithm of county density and a series of dummy variables representing classes of city size. To

form these dummy variables the counties of Ontario were arranged in order of the size of their largest cities. On the basis of this array, ten classes were defined. The breaking points between classes had to be judgmental, but consideration was given to maintaining the smallest percentage difference between classes while keeping the total number equal to ten. Table 2.1 displays the outcome.

Regression 1 now takes the following expanded form:

$$y_{hi} = \alpha_h \log p + \sum_{r=1}^{9} \beta_{hr} d_r + \sum_{s=1}^{n} \gamma_{hs} x_{hs} + \beta_{ho} \qquad (h=1,.....,110) \quad (2)$$

where d_r is a dummy variable taking on the value one if the largest city in county h is in class size r and zero otherwise, p is county density, and β_{ho} is a constant. Ten city classes are defined in Table 2.1 but, because of the presence of the constant in regression (2), only nine dummy variables are independent. The d_r appear as unity once only in each row of the data matrix and, with a constant in the regression equation, the last column would consist of all ones. The data matrix would therefore be deficient in rank. This is remedied by leaving the last dummy variable (which represents the smallest city size) out of the regression. The remaining d_r are then interpreted as representing the effect of any larger city size relative to the smallest.

If production of each industry were allocated by county in strict proportion to population it would be sufficient in regression (2) to adopt the density variable by itself in linear form. Such a relationship is not predicted by Central Place Theory, however, and furthermore, empirical studies suggest that the relationship is not linear - the rate of increase declines with increase in city size. When the dummy variables are used together with all other variables, they introduce considerable freedom of form for the expression of density. In any given range of city size, the independent variable is a linear function of the logarithm of county density, and if α_h is positive the slope of this expression is necessarily declining. If this is contrary to the empirical facts, the estimated parameters of the logarithm function can, at best, produce an expression which is approximately linear. If, in fact, the true slope should be rising with density, this would be revealed in the empirical results, because the coefficients of the dummy variables would be increasing in size for cities which are larger in population.

TABLE 2.1
Classification of counties by size of largest city

City	Class	In county	Population	Area	Density
Toronto	I	Toronto	712786.	37.51	19003.
Hamilton	II	Wentworth	309173.	47.42	6520.
Ottawa	II	Ottawa-Carleton	302341.	42.53	7109.
London	III	Middlesex	223222.	61.95	3603.
Windsor	III	Essex	203300.	46.24	4397.
Mississauga	III	Peel	156070.	106.13	1471.
Kitchener	IV	Waterloo	111804.	25.72	4347.
St. Catharines	IV	Niagara	109722.	36.46	3009.
Thunder Bay	IV	Thunder Bay	108411.	124.89	868.
Oshawa	IV	Ontario	91587	21.26	4308.
Sudbury	IV	Sudbury	90535.	46.55	1945.
Burlington	IV	Halton	87023.	84.18	1034.
Sault Ste. Marie	V	Algoma	80332.	85.58	939.
Brantford	V	Brant	64421.	17.54	3673.
Guelph	V	Wellington	60087.	26.45	2272.
Kingston	V	Frontenac	59047.	10.97	5383.
Peterborough	V	Peterborough	58111.	20.46	2840.
Sarnia	V	Lambton	57644.	12.65	4557.
North Bay	VI	Nipissing	49187.	108.44	454.
Cornwall	VI	Stormont	47116.	24.40	1931.
Markham	VI	York	36684.	81.58	450.
Chatham	VI	Kent	35317.	8.53	4140.
Belleville	VI	Hastings	35128.	9.28	3785.
Timmins	VII	Cochrane	28542.	4.74	6022.
Barrie	VII	Simcoe	27676.	11.18	2475.
Woodstock	VII	Oxford	26173.	9.43	2776.
St. Thomas	VII	Elgin	25545.	7.01	3644.
Stratford	VII	perth	24508.	7.85	3122.
Brockville	VIII	Leeds	19765.	7.97	2480.
Owen Sound	VIII	Grey	18469.	9.44	1956.
Pembroke	VIII	Renfrew	16544.	3.99	4146.
Lindsay	IX	Victoria	12746.	5.90	2160.
Cobourg	IX	Northumberland	11282.	4.51	2502.
Kenora	IX	Kenora	10952.	5.92	1850.
Simcoe	IX	Norfolk	10793.	3.56	3032.
Fort Frances	X	Rainy River	9947.	10.24	971.
Huntsville	X	Muskoka	9784.	270.63	36.
Smith Falls	X	Lanark	9585.	2.60	3687.
Hawkesbury	X	Prescott	9276.	2.49	3725.
Bowmanville	X	Durham	8947.	5.67	1578.
Orangeville	X	Dufferin	8074.	2.45	3296.
Goderich	X	Huron	6813.	2.49	2736.
Parry Sound	X	Parry Sound	5842.	1.87	3124.

TABLE 2.1 (continued)

City	Class	In county	Population	Area	Density
Dunnville	X	Haldimand	5576.	1.73	3223.
New Liskeard	X	Timiskaming	5488.	2.48	2213.
Prescott	X	Grenville	5165.	1.56	3311.
Picton	X	Prince Edward	4875.	1.21	4029.
Napanee	X	Lennox, Addington	4638.	1.62	2863.
Walkerton	X	Bruce	4479.	2.21	2027.
***	X	Dundas	0.	0.00	0.
***	X	Glengarry	0.	0.00	0.
***	X	Haliburton	0.	0.00	0.
***	X	Manitoulin	0.	0.00	0.
***	X	Russell	0.	0.00	0.

*** These counties have no cities with population greater than 4000
SOURCE: Statistics Canada (94-708,1973)

Industrial characteristics and regional specialization, trade and development

This project is based on the assumption that there are distinct differences among Ontario's regions with regard to their population density, city size and resource base. As noted, the variables in regression (2) above were chosen to reflect the forces which are isolated by the Heckscher-Ohlin Theorem and Central Place Theory. These jointly determine the location of production and, since individuals in different regions are assumed to be similar in their demand for goods, each region will need to export commodities which are produced from its specialized industries, and import goods which are not locally produced in sufficient quantity to meet consumption requirements.

Regressions for each of 110 manufacturing industries of the kind defined in equation (2) are fitted, using employment data by county. The results, reported in Chapter Three, show that the location of most industries can be explained rather well by the macroeconomics variables described above. The question of regional disparities, therefore, can be approached by matching the industrial characteristics of each industry to the existing industrial structure, population, and resource characteristics of the region, in order to determine which are most suitable for the purposes of development. An alternative approach is to note cases where an

industry is absent in a less favoured region even though it appears to be well matched in terms of its macroeconomic variables. In either case, however, microeconomic variables should be studied before definitive policy measures are taken.

Finally, this study considers the basis of comparative advantage in each of the regions and inquires whether or not it is reflected in the region's export performance. There is a description in Chapter Four of each of the regions in terms of its resources, present industries, and population densities, and a comparison of the regions to Ontario as a whole, and to Canada. As a result of such comparisons of the resource bases of the regions and of factors relating to density, we expect certain commodity exports. Since these trade patterns conform to that predicted by theory, it represents further evidence supporting that obtained from the regression equations.

Data sources

Except for three sources, the data used in the study are obtained from the published sources cited in the text or as footnotes to the tables. Input-Output data describing the value of output from each industry shipped to every other industry were obtained from Customer Services, Structural Analysis Division. These were used to identify the most important suppliers to each industry, and most important buyers from each industry. Data describing employment by industry in 54 counties for each of 110 manufacturing industries was obtained as a special tabulation from Data Dissemination, Census Field, Statistics Canada. Trade by commodity classification by region of Ontario was obtained from the Canadian Institute of Guided Ground Transport. These data report, according to a two-digit commodity classification, the exported and imported commodities in 1975 from each Ontario region to every other region, to the rest of Canada and the world, exclusive of commodities moved by pipeline but inclusive of shipments by truck, rail and surface vessel. The trucking data were obtained from sampling procedures. The commodity definitions and data are described in detail in Graham (1975).

CHAPTER THREE

EMPIRICAL RESULTS RELATING TO INDUSTRIAL LOCATION

The objective in this chapter is to report the empirical results of regressions whose rationale and empirical form was discussed in the previous chapter. In each of the 110 industries, the dependent variable is employment by county. It was established in the previous chapter that there are four types of independent variable which could explain the location by county of the dependent variable. These are 1) related resources in the county, 2) related industrial buyers of output or sellers of intermediate products in the county, 3) characteristics of city size, and 4) county density. Industrial type variables are measured as the percentage of total Ontario employment and, as explained in the previous chapter, city sizes are entered in regressions as zero-one dummy variables, while county density is entered as logarithm of county density.

Variables of the first or second type listed above are called purchaser-supplier variables. When an industry locates near a source of supply it is said to be backward linked to the supply. If it locates near a buying industry we refer to it as forward linked to a buyer. In the context below the third and fourth on the list above are called city size and county density variables. The sections reporting statistical results are grouped according to the Standard Industrial Classification. In order to give the reader some guidance concerning which variable is being explained in a particular context, the industry which serves as the dependent variable is underlined when first mentioned. For brevity, the author often refers to the industry name, e.g. Knitting Mills (239), as the variable. To be strictly correct, the reference should be percentage employment in Knitting Mills (239). As noted in the first chapter, the number of parentheses is the Standard Industrial Classification.

Statistical methods

This is a cross-sectional study using ordinary least squares as the statistical tool. The success or failure of a particular variable is judged by its statistical significance in regression relationships in which the dependent variable is always expressed as a percentage of Ontario employ-

ment engaged in a particular industry. As noted above, the percentage employed in principal selling industries and the percentage employed in the principal buying industries constitute one set of independent variables. Since, for theoretical reasons, these transactions had to be positively related to output, a one-tailed test of significance based on the t-distribution was used, with $t = 1.6$ chosen as the critical value. At forty degrees of freedom, $t \geq 1.6$ is expected with a probability of about 0.06. Below this value of t the regression coefficient was considered insignificantly different from zero. The coefficient of logarithm county density also was assumed, for theoretical reasons, to be positive and the same value of t was used for this test. On the other hand, the coefficients of dummy variables could be of either sign and, therefore, the test value was set at $t = 2.0$ to provide a two-tailed test with a probability of about 3 per cent at each extreme. (The probability of $t \geq 2.0$ is approximately three per cent with forty degrees of freedom).

In each regression there are implicitly three hypotheses. The first states that location is determined by an industry's technological relationships to other industries. The second states that location is determined by city size and county density variables. The third states that both types of variables are required. To test these hypotheses the standard F-test (Johnson, 1060, Chapter 4) is used, involving two parameters usually referred to as the "number of degrees of freedom in the numerator" and the "number of degrees of freedom in the denominator". It can be shown (Johnson, 1960, Chapter 4) that the t-test for individual coefficients is equivalent to the F-test and therefore this test is adopted when there is only one technological variable being considered.

The F-test is occasionally used below to determine if a set of variables has significantly explained part of the variance in the independent variables, but usually this is obvious from the value of the multiple correlation coefficient presented with each equation. The multiple correlation coefficient squared is abbreviated RSQ. In order to compare RSQ between regressions which differ in the number of right-hand-side variables present, it is useful to have RSQ*, which is the same as RSQ except that it adjusts for the number of degrees of freedom present, and can be negative. RSQ is needed for the appropriate F-test to determine if all supplier-purchaser variables are collectively significant, if all city size and county density variables are collectively significant, or if both sets together are significant.

TABLE 3.1
Frequency distribution for the regression equations of 110 industries: percentage of explained variance adjusted for degrees of freedom

Percentage of Explained Variance	Number
Under 10	6
10 - 20	3
20 - 30	3
30 - 40	4
40 - 50	6
50- - 60	10
60 - 70	5
70 - 80	17
80 - 90	12
Over 90	44
	110

Having made such a test, the question then arises whether or not supplier-purchaser variables significantly add to the variance explained by the city size and county density variables, or vice versa. If, according to the F-test (or t-test), both city size and county density variables add significantly to variance explained by the other set, and further, if both sets together are jointly significant according to the F-test, then it is concluded that both supplier-purchaser variables and city size and county density variables are needed to explain the variance of the dependent variable. This is the result in 39 out of 110 cases.

If the city size and county density variables are significant alone and the supplier-purchaser variables do not, according to the F or the t-test, add significantly to this variance, it is concluded that the city size and county density variables alone explain location best. This is the result in 32 out of 110 cases. If the supplier-purchaser type variables are significant and the city size and county density variables fail to add significantly to the explained variance it is concluded that the supplier-purchaser variables explain location best. This was the outcome in 20 out

of 110 cases. In four cases ambiguity arose. Neither set added significantly to the variance explained by the other, but both sets together were jointly significant. In 15 cases out of 110 the explained variance was so low that it was necessary to conclude that there was no explanatory power in either set of variables alone or jointly. The tables in this chapter only report the results which according to the above criteria were statistically best. In the four cases where there is ambiguity concerning which variables are best, and in cases where there are is not statistically significant explanatory power, the regression with all variables present is reported in the tables.

In almost all cases, when negative coefficients were obtained contrary to theory they either failed to be significant or were produced through the effects of multicolinearity. The problem of multicolinearity arises when the data matrix X used in the estimation process is deficient in rank and the maxtix X'X cannot be inverted. Rank is well defined mathematically, and strictly speaking the rank of any matrix cannot be open to question. Statistically matrices are almost always of full rank because of the presence of random factors, and X'X can be inverted, but may be numerically weak and unstable if det X'X is near zero. There is no statistical test for multicolinearity but it can be expected to arise when the independent variables are highly correlated pairwise.

In the case of six textile industries these correlations were at least 0.90 (0.85 in one case). The percentage of employment in any county was nearly the same for all. It was decided, therefore, to replace all six with a single principal component. The principal component was taken from the clothing vectors in their natural form, percentage employment. Since these percentages are pure numbers it was not necessary to normalize them by taking deviations from the mean or expressing them in units of the standard deviations. The first principal component, therefore, is a linear combination of the six clothing vectors weighted by coefficients which indicate the importance of each clothing industry in the combination. Furthermore, since all dependent variables in this study are expressed as percentages, the principal component for the clothing sector was adjusted by a scalar to add up to unity for comparability. A similar procedure was applied to five industries in the pulp and paper sector.

These adjustments greatly stabilized the results obtained from the study. Whereas previously the addition or deletion of variables relating to

resources or linkages would shift the sign, size and level of significance of variables relating to density, after adjustment to principal components they become much less variant.

Food and beverages

The food and beverage industries are engaged in the first stage of processing commodities produced from land. These include meat slaughtering, dressing and packing, filleting fish, canning and freezing fruits and vegetables, processing raw milk, milling wheat and producing feeds for animals. One would expect there to be a larger percentage of employment in these industries in counties where the percentage of improved land is large. This is true, but in most cases city size and county density variables are also significant (S.I.C. 104, 106, 107, 108, 109). The hypothesis that city size and county density variables are a locational factor was rejected in only three industrial classes (S.I.C. 102, 103, and 105). In one industry, location is statistically determined soley by city size and county density variables.

The group of activities where the backward and forward linkages fail to be significant are officially described in the Meat and Poultry Products Industries (101). The principal suppliers are producers of agricultural commodities and the principal buyers are firms providing Accommodation and Food. Neither of these produced significant coefficients, nor did improved land acreage in the county. Judged in terms of significance of the coefficient and its size, one would have to conclude that the unique event dummy variable representing the Toronto region dominates the others in determining the percentage of employment by county, although the coefficient for city size IV, 87,000 to 112,000, and logarithm county density were also significant.

The three industries whose locations are explained without the use of city size or county density variables are the Fruit and Vegetable Processing Industries (103), the Flour and Breakfast Cereal Products Industry (105), and the Fish Products Industry (102). Unlike the processing in the Meat and Poultry Products Industries (101), which takes place in large cities, the drying, canning, curing, freezing, smoking and packing of fish constitutes a set of activities located near the site where fish are landed. To explain employment in the Fruit and Vegetable Pro-

Table 3.2
Statistical results of regressions in the food and beverage industries

Independent Variables	Dependent Variable: Counties' Proportion of Ontario in Industry: 101 Meat + Poultry	102 Fish Products	103 Fruit + Vegetable	104 Dairy Products	105 Flour + Cereal	106 Feed	107 Bakery Products	108 Misc. Food	109 Beverage
Dummy Var. : >712	.373(11.2)	--	--	.192(15.5)	--	.054(3.3)	.297(7.4)	.352(12.5)	-.038(.2)
Observation : 302-310	.030(1.3)	--	--	.021(2.6)	--	-.011(1.1)	.037(5.2)	.033(.3)	-.023(.9)
Is Unity : 156-224	.015(.8)	--	--	.021(3.2)	--	-.004(.5)	.023(3.4)	.019(2.4)	.070(5.1)
If Pop. of : 87-112	.032(2.4)	--	--	.016(3.3)	--	.014(2.2)	.016(3.8)	.003(.5)	.014(1.5)
Largest : 57- 81	-.001(.1)	--	--	.008(1.7)	--	.012(2.0)	.002(.6)	-.003(.5)	-.003(.5)
City in : 35- 50	-.000(.0)	--	--	.005(1.0)	--	.004(.6)	.005(1.1)	.002(.4)	.004(.6)
County, to : 24- 29	.003(.2)	--	--	.006(1.2)	--	.017(2.5)	.003(.6)	-.003(.4)	-.003(.4)
Nearest : 16- 20	.001(.0)	--	--	.003(.5)	--	.008(1.0)	.004(.8)	-.004(.5)	-.003(.3)
Thousand is : 10- 13	.003(.2)	--	--	.003(.5)	--	.004(.5)	.002(.4)	.012(1.9)	-.002(.3)
Log 10 County Density	.013(1.9)	--	--	.003(1.0)	--	.007(2.0)	.001(.4)	.004(1.3)	-.001(.3)
Purchases from									
Improved Land (Acres)	--	--	.779(2.7)	.185(1.6)	.790(2.0)	.649(4.3)	--	--	.186(1.1)
Fishing Employment	--	2.072(8.9)	--	--	--	--	--	--	--
105 Flour + Cereal	--	--	--	--	--	--	.095(3.1)	--	--
273 Paper Box + Bag	--	--	--	--	--	--	.180(2.0)	--	--
304 Metal Stamping	--	--	.235(1.1)	--	--	--	--	--	--
Supplies To									
Misc. Services	--	--	--	--	--	--	--	--	.771(2.1)
Accommodation + Food	--	--	.350(1.2)	--	--	--	--	--	--
101 Meat + Poultry	--	--	--	--	--	--	--	.278(3.9)	--
106 Feed	--	--	--	--	--	--	--	.003(.0)	--
107 Bakery Products	--	--	--	--	.576(5.6)	--	--	--	--
Constant	-.107(1.5)	-.020(2.8)	-.007(.9)	.001(.2)	-.007(.7)	-.001(2.2)	.001(.2)	-.002(.4)	-.001(.1)
R Squared	.8370	.6043	.4817	.9101	.3978	.6666	.9833	.9773	.9381
RBAR Squared	.7991	.5967	.4506	.8865	.3742	.5793	.9784	.9706	.9200

cessing Industries (103) three purchaser-supplier type variables were used: the percentage of Improved Land, employment in the Metal Stamping, Pressing and Coating Industry (304), and Accommodation and Food. The percentage of Improved Land is the only significant variable.

Firms in the Flour and Breakfast Cereal Products Industry (105) classification locate near those in the Bakery Products Industries (107), and vice versa. Although both the Bakery Products Industries (107) and Improved Land acreage is significant, the overall fit is poor and barely significant. Because of this we conclude that there are other factors of importance in the location decision of many firms. Since Improved Land is significant we conclude that extensive research at the level of the firm may reveal that there is a proportion of production which can be economically pursued in smaller town nearer the resource site. If this is true it would have repercussions on the location of the Bakery Products Industries (107). As a supplier, the presence of a firm in the Flour and Breakfast Cereal Products Industry (105) classification is a factor encouraging the location of Bakery Products Industries (107). The best regression results for the Bakery Products Industries (107) are obtained when, in addition to the Cereal Products Industry (105), the Paper Box and Bag Manufacturers (273) and the city size and county density variables are also present as independent variables. Firms engaged in production of Bakery Products (107) are attracted to larger cities, but the presence of suppliers is an independent locational force of significance. Because the Cereal Products Industry is recommended for further study, the effects of this industry on the location of the Bakery Products (107) should also be examined in more detail.

In the remaining industries to be discussed in this section, city size and county density variables are significant locational factors, suggesting that the prospects are not as great for shifts toward the resource site or to rural areas and small towns. Firms in the Dairy Products Industry (104) produce a wide variety of products: powdered milk, cream, ice cream, cheese, yogurt etc. The percentage employed in such types of production rises significantly with the size of the largest city in the county (classes I, II, III, IV), producing an excellent fit, but logarithm county density is not significant. When added to these variables, percentage of Improved Land is just over the threshold of significance value (1.6). The location of the Beverage Industries (109) is explained by the

city size and logarithm county density variables, Improved Land and Miscellaneous Services. This is also true for establishments in the Feed Industry (106), except that Miscellaneous Services would not be among the regressors.

The Miscellaneous Food Industries (108) classification represents a wide range of economic activities including frozen dinners, glucose manufacturing, rice milling, and salad oils. The city size and county density variables, and employment in the Meat and Poultry Products Industries (101), are significant variables. Although it is a large supplier to Miscellaneous Food Industries (108), the Feed Industry (106) is not significant.

Considering this group of industries in general, it is found that city size under 81,000 is never a locational factor except in the case of the Feed Industry (106), and that county density is a location factor only in the case of Meat and Poultry Industries (101) and the Feed Industry (106). The Paper Box and Bag Manufacturers (273) and firms in the Metal Stamping, Pressing and Coating Industry (304) classification do provide statistically significant location influence in some of the industries considered. These activities, however, are influences whose locations are unlikely to change (see below). The location of Paper Box and Bag manufacturers (273) is explained by city size alone, and Metal Stamping, Pressing and Coating Industry (304) by the presence of Iron and Steel Mills (291), city size, and county density. Because of their direct or indirect connection to Improved Land, there are three classifications where microeconomic study might prove the existence of some scope for shifting towards smaller cities and less dense areas: the Flour and Breakfast Cereal Products Industry (105), the Fruit and Vegetable Processing Industries (103), and the Bakery Product Industries (107).

Tobacco, rubber and leather

The industries in the tobacco, rubber and leather section of the S.I.C. are oriented to the market as described by city size and county density variables. Statistical evidence failed to confirm backward linkages in several classifications where it was expected. No backward linkages, for example, explain the location of Leather Tanneries (172) which are concentrated in Toronto county and city classification IV.

As the only independent variable, percentage employment in Leather Tanneries (172) is a significant backward linkage explaining percentage employment in Shoe Factories (1974), but it is not significant when regressed with city size and county density variables. Although city size variables are significant as a group there is no statistical evidence that large cities other than Toronto influence location, and we conclude that on balance the evidence does not support Leather Tanneries (172) as a backward linkage explaining the location of Shoe Factories (174). A similar result holds when the Luggage, Handbag and Small Leather Goods Manufacturers (179) industry is the dependent variable (see below). The Leather Tanneries (172), as a possible backward linkage, do play a role in the explanation of the percentage employment in the Leather Glove Factories (179), but it explains only 6.3 per cent of the variance in the dependent variable.

It is not surprising that the variables considered in this study were not sufficient to determine the location of Leaf Tobacco Processors (151). Such production is concerned with packaging, aging, grading and redrying leaf tobacco which, it was expected, would be pursued on farms on which leaf tobacco is grown. But land suitable for tobacco is specialized and its distribution is not identical with the distribution of arable land in general. No single variable is significant, and all variables considered jointly fail to be significant. The Tobacco Products Manufacturers (153) classification is at the next stage of processing with output consisting of chewing tobacco, cigarettes, cigars and pipe tobacco. Here again it is found that the location of the resource processing stage, Tobacco Products Manufacturers (153), is not statistically related to the percentage employment in Leaf Tobacco Processors (151). A regression with only city size and county density variables is most successful. Processing takes place predominantly in Toronto county with, in this case, some propensity for production in city size class V (57,000 to 81,000).

There are two classifications where the backward linkage plays some role, but in both this occurs in relationships at the later stage of processing. The Rubber Products Industries (162) represent a collection of firms producing a wide range of output at the end product stage. Employment in the supplier classification Man-made Fibre, Yarn and Cloth Mills (182) is statistically significant as a determinant of location, but this is also true of the purchasing classification Wholesale Trade. Furthermore,

Table 3.3
Statistical results of regressions in the Tobacco, Rubber and Leather Industries

Independent Variables		Dependent Variable: Counties' Proportion of Ontario Employment in Industry: 151 Leaf Tobacco	153 Tobacco Products	162 Rubber Products	165 Plastics	172 Leather	174 Shoe Factories	175 Leather Gloves	179 Luggage
Dummy Var.	> 712	-.031(.3)	.328(7.8)	-1.827(3.9)	-1.051(4.2)	.210(5.7)	.225(5.3)	-.054(.6)	.389(15.1)
Observation	302-310	-.017(.3)	.005(.2)	- .166(3.4)	- .139(5.2)	-.031(1.2)	.006(.2)	-.052(1.1)	.008(.6)
Is Unity	156-224	.051(1.2)	.024(1.0)	- .147(3.2)	- .083(3.3)	-.023(1.1)	.011(.5)	-.044(1.1)	-.002(.2)
If Pop. of	87-112	-.004(.1)	.008(.5)	- .036(1.5)	- .035(2.6)	.039(2.6)	.037)2.1)	.049)1.6)	.014(1.6)
Largest	57- 81	-.012(.4)	.038(2.2)	- .037(2.7)	- .021(2.9)	.005(.3)	-.005(.3)	-.012(.4)	.003(.4)
City In	35- 50	.047(1.5)	.001(.0)	- .043(2.9)	- .021(2.5)	.005(.3)	.016(.9)	.003(.1)	.005(.6)
County, Fo	24- 29	.025(.8)	.008(.5)	- .015(1.1)	- .012(1.5)	.023(1.5)	-.001(.0)	-.010(.4)	.014(1.7)
Nearest	16- 20	-.014(.4)	-.003(.1)	- .016(1.0)	- .002(.3)	-.005(.3)	.000(.0)	-.010(.3)	-.002(.2)
Thousand is	10- 13	.067(2.0)	.009(.5)	- .005(.4)	.008(1.1)	.025(1.5)	.002(.1)	.085(2.6)	.007(.8)
Log 10 County Density		.009(.5)	.012(1.4)	.004(.5)	.003(.7)	.002(2.9)	.014(1.6)	.036(2.3)	.008(1.9)
Purchases From									
Improved Land (Acres)		1.061(1.5)	--	--	--	--	--	--	--
172 Leather		--	--	--	--	--	--	.027(.1)	--
183 Man-made Fibre		--	--	.204(2.4)	--	--	--	--	--
373 Plastic + Synth, Resin		--	--	--	.203(2.5)	--	--	--	--
Supplies to									
Wholesale Trade		--	--	4.590(4.4)	3.062(5.3)	--	--	--	--
153 Tobacco Products		.069(.3)	--	--	--	--	--	--	--
174 Shoe Factories		--	--	--	--	--	--	--	.304(4.2)
323-5 Motor Vehicle		--	--	.090(.7)	.048(.7)	--	--	--	--
Constant		-.028)1.1)	-.016(1.1)	- .016(1.5)	- .010(1.6)	-.030(2.3)	-.016(1.1)	-.048(1.9)	-.012(1.8)
R Squared		.2813	.7136	.7849	.9511	.6798	.5865	.3246	.9532
RBAR Squared		.0709	.6470	.7150	.9351	.6053	.4905	.1477	.9409

city size and county density variables are jointly significant. The Rubber Products Industries (162) cluster near Wholesale Trade outlets and near suppliers of Man-made Fibre, Yarn and Cloth Mills (183) but, given similar facilities, the county with a smaller city would be preferred. In the Plastics Fabricating Industry (165) the supplier is Manufacturers of Plastics and Synthetic Resins (373). Principal purchasers are Wholesale Trade and Motor Vehicles and Parts Manufacturers (323, 325). The coefficients for the backward linkage and Wholesale Trade are significant, and the city size and county density variables add significantly to the explained variance. The forward linkage is also a successful variable in the regression in which Luggage, Handbag and Small Leather Goods Manufacturers (179) is the dependent variable. Some of the output consists of parts for shoe production, and hence this classification is a supplier to Shoe Factories (174). This industry is a forward linkage which, with Toronto county and logarithm county density, is statistically significant.

In the range of the S.I.C. considered in this section, the products are technologically related to the earliest stages of resource processing, yet the location of employment at the later stage is not influenced by backward linkages. Rather they are determined by city size and county density variables. For firms classified as Leaf Tobacco Processors (151) or Leather Glove Factories (175) no set of variables is significant. There is dependence in some industrial classifications on imported resources (rubber or crude petroleum) which are not produced in Ontario, and this may account for the attraction of larger cities, where transportation facilities are available.

Knitting mills and clothing

Firms belonging to this group of industries represent the later stage of processing textiles. Their most common characteristic is that they locate together. The simple correlation coefficient between the percentage employment in any one with any other is very high. In the group with S.I.C. numbers 243 to 249, such correlations are all over 0.85, with two over 0.90. This presented certain technical problems from a statistical point of view (discussed in the introduction) which were resolved by representing all six industries as a single composite designated in the table as the Clothing Principal Component. Sample correlations between this composite

and the six industries it represents are 0.956, 0.994, 0.980, 0.995, 0.927 and 0.967 respectively for S.I.C. 243, 244, 245, 246, 248 and 249. Policy measures affecting any one of these would need to consider every other and, furthermore, policies which make one of them locationally attractive are likely to attract all the others.

Since the Clothing Principal Component is a combination of the six industries discussed in sequence below, it cannot also be an independent variable explaining any of the six. Concerning such variables, it may be stated as a generality that all six are market-oriented, but there are exceptions to this.

One of the six is the Men's Clothing Industries (243). The percentage employment in this classification can be well described (RSQ* = 0.94) by percentage employment in Knitting Mills (239) and Wholesale Trade. After taking into account the locational impact of Wholesale Trade and percentage employment in Knitting Mills (239), there is no evidence supporting a propensity for the Men's Clothing Industries (243) to locate in large cities. This is also true of the supplier to Men's Clothing - Knitting Mills (239). Knitting Mills (239) are located near purchasing industries represented by suppliers of Man-made Fibre, Yarn and Cloth Mills (183) and, other things being equal, larger cities are not locationally attractive.

The second of the six S.I.C. classifications represented by the Clothing Principal Component is the Women's Clothing Industries (244). In this case the city size and county density variables offer an empirically better explanation of location than does Wholesale Trade and Knitting Mills (239). The Toronto market dominates locational considerations rather than the presence of purchaser and supplier industries.

The results obtained regarding two of the other three industrial classifications which form the Clothing Principal Component are ambiguous because of the high correlation between Wholesale Trade and the Toronto county variable. The results obtained when the city size and county density variables are regressed alone suggest that Children's Clothing (245) may be regarded as locating in cities over 156,000 and avoiding smaller cities. Alternatively, location may be described as being statistically determined by the presence of Wholesale Trade. Either the city size and county density variables, or Wholesale Trade, can explain a large percentage of the variance in the independent variable, but neither

Table 3.4
Statistical results of regressions in the Knitting Mills and Clothing Industries

Dependent Variable: Counties' Proportion of Ontario Employment in Industry:

Independent Variables		231 Hosiery	239 Knitting	243 Men's Clothing	244 Women's Clothing	245 Child.'s Clothing	246 Fur Goods	248 Foundatn Garments	249 Misc. Clothing	Clothing Princ. Comp.
Dummy Var	>712	.433(11.3)	--	--	.799(101.)	.628(1.8)	.589(7.3)	.538(15.5)	.549(19.3)	.531(4.6)
Observation	302-310	.019(.7)	--	--	.002(.4)	.078(2.0)	-.017(1.8)	.082(3.5)	.016(.8)	.025(1.9)
Is Unity	156-224	.028(.3)	--	--	.018(4.1)	.015(.5)	-.018(2.4)	.004(.2)	.016(1.0)	.001(1)
If Pop. Of	87-112	.003(.2)	--	--	.000(.1)	-.003(.2)	-.006(1.6)	.001(.1)	.003(.3)	-.002(.3)
Largest	57- 81	.007(.5)	--	--	.002(.7)	-.003(.3)	.002(.8)	-.001(.1)	.025(2.2)	.003(.8)
City In	35- 50	.000(.0)	--	--	.000(.1)	-.004(.3)	-.002(.7)	.002(.1)	.010(.9)	.001(.2)
County, To	24- 29	.045(2.8)	--	--	.003(1.0)	-.004(.3)	-.002(.9)	-.002(.1)	-.000(.0)	-.004(1.0)
Nearest	16- 20	-.002(.1)	--	--	.004(.9)	-.003(.2)	-.002(.6)	.063(3.5)	.001(.1)	.009(2.0)
Thousand Is	10- 13	.001(.1)	--	--	-.001(.3)	-.001(.1)	-.001(.5)	-.003(.2)	.002(.1)	-.001(.3)
Log 10 County Density		.008(1.0)	--	--	.001(.8)	.003(.5)	-.001(.6)	-.001(.1)	.004(.7)	.001(.4)
Purchases From										
183 Man-Made Fibre		--	.191(2.0)	--	--	--	--	--	--	--
239 Knitting		--	--	.511(6.4)	--	.022(.2)	.099(.3)	--	--	.282(1.0)
Supplies To										
Wholesale Trade		--	--	.732(9.6)	--	.111(.1)	.632(3.3)	--	--	.282(1.0)
Clothing Princ. Comp.		--	.525(12.2)	--	--	--	--	--	--	--
Constant		-.010(.8)	.005(1.2)	-.004(1.8)	-.000(.2)	-.003(.3)	-.000(.2)	.004(.3)	-.005(.5)	-.001(.2)
R Squared		.8249	.7561	.9438	.9970	.9652	.9987	.8922	.9263	.9958
RBAR Squared		.7842	.7466	.9415	.9964	.9550	.9983	.8671	.9092	.9946

significantly affects the explained variance when both are present in the regression. Under the hypothesis the industry is dominated by market considerations: in the one case by Wholesale Trade and in the other by Toronto county. In the Fur Goods Industry (246), on the other hand, both sets of variables significantly reduce the variance in the percentage employed by county when the other set is present. The results imply that Toronto county and Wholesale Trade should be combined into a single equation.

The last two industries which are part of the composite represented by the Clothing Principal Component are the Foundation Garment Industry (248) and Miscellaneous Clothing Industries (249). We were unsuccessful in finding statistically significant supplier or purchasing industries for Miscellaneous Clothing (249), but the city size and county density variables are significant as a group, and explain a large percentage of the variance of the dependent variable. The Toronto county variable is significant and large relative to the coefficients of the other dummy variables. The percentage employment in the Foundation Garmet Industry (248) can best be explained by city size and county density variables. The size of largest city in county, particularly Toronto county, is the factor favourable to location of employment in the Foundation Garmet Industry (248).

As noted above, the Clothing Principal Component represents the percentage employment by county of six industries: S.I.C. 243, 244, 245, 246, 248 and 249. It is therefore a means of empirically exploring the locations of these collectively. Examination of the purchases and sales of the six reveals that there are two candidates as independent variables - percentage employment in Knitting Mills (239), and percentage sales from Wholesale Trade. These are successful by themselves and, when present with city size and county density variables, add significantly to the variance of the dependent variable. This statement also applies to the city size and county density variables. They offer a satisfactory empirical description alone, but also add significantly to the explained variance when present with the purchaser-supplier variables. If we regard the regression in which all are present as a representation of six industries, then the Toronto county variables plus the percentage employment in Knitting Mills stands out as empirically the best explanation for location.

All of the products considered in this section are nearer the end

stage of processing and make no direct purchase of resource commodities. This may explain the orientation in favour of location in counties with larger cities size. This is also confirmed in the case of Hosiery Mills (231). The percentage employment is explained by city size and county density variables alone. No supplier-purchaser variable is significant. Ontario's resource base excludes the cotton, wool and natural rubber which might prove a locational factor at the earlier stages of processing. Ontario does, nevertheless, offer one feature which is empirically established as important locationally - the density of Toronto county per se. Obviously this is something that Ontario has to offer which is unavailable in the less dense regions, unless a new centre could be created where all such production might be encouraged to locate. In this regard, Knitting Mills (231) seem to play a role that should be subject to more extensive study. They are a significant backward linkage for the aggregated Clothing Principal Component which represents six of the clothing classifications and is explicitly significant in the case of the Men's Clothing Industries (243). There is a significant backward linkage of Men's Clothing Industries (243) to Man-made Fibre, Yarn and Cloth Mills (183).

The Clothing Principal Component represents six of the nine industries discussed in this section, and thus is an indication of the forces which are at work on the section as a whole. Both supplier-purchaser variables and the city size and county density variables add significantly to the variance explained by each other. The regression is an exceedingly good fit. Toronto county and percentage employment in Knitting Mills (239) are significant independent variables.

Textile industries

The textile industries represent an earlier stage of processing for the knitting mills and clothing industries. This estalishes the hypothesis that forward linkages will prove successful independent variables, and that city size and county density variables will prove less useful. This is not the case. Forward linkages are generally successful but only in conjunction with city size and county density variables. There are only two cases of backward linkages. In the Miscellaneous Textile Industries (189), the Clothing Principal Component is a significant buyer (forward linkage), and Cotton Yarn and Cloth Mills (181) is a significant seller (backward linkage);

no city size or county density variables were significant. In the Wool Yarn and Cloth Mills (182) classification, Man-made Fibre, Yarn and Cloth Mills is a significant backward linkage and the Clothing Principal Component is a significant forward linkage. City size and county density variables are significant, but city size classes I, II and III are negative, indicating that, other things being equal, large cities are avoided.

Backward linkages failed to be significant in all other classifications. No locational factors were significant in the case of Man-made Fibre, Yarn and Cloth Mills (183) or for the Cordage and Twine Industry (184). For firms in the Carpet, Mat and Rug Industry (186) and the Canvas Products, and Cotton and Jute Bags Industries (187), empirical evidence favours consideration of the city size and density variables alone. In the Carpet, Mat and Rug Industry (186), the percentage employment rises proportionate to the logarithm of density. Toronto county and city size V coefficient are significant. In the Cotton and Jute Bags Industries (187) larger cities, especially Toronto, are a significant locational force which seems to overshadow the buyer industry, Miscallaneous Vehicle Manufacturers (329), as a locational factor.

In the remaining classification the most successful regressions involved a combination of a forward linkage with city size and county density variables. As might be anticipated, the location of the Automobile Fabric Accessories Industry (188) is explained by the purchasing classification Motor Vehicles and Parts (323, 325) in combination with city size and county density variables. The empirical results obtained when Cotton Yarn and Cloth Mills (181) is the dependent variable establishes the Clothing Principal Component as a significant independent variable but, other things being equal, large cities (size I and III) are avoided. The city size and county density variables must also be part of the locational description of percentage employment in Felt and Fibre Processing Mills (185). The percentage employment in the buyer industry, Wool Yarn and Cloth Mills (182), and Toronto county, carry significant positive coefficients. All other city size variables are either negative or positive, but not significant; logarithm county density is not significant.

The textile industries are market-oriented, and in general it may be said that either city size and county density, or forward linkage, or both, explain location. However, there is evidence that, other things being equal, location outside the large cities is preferred. In the last section it

Table 3.5
Statistical Results of Regressions in the Textile Industries

Dependent Variable: Counties' Proportion of Ontario Employment in Industry:

Independent Variables	181 Cotton Yarn, Cloth	182 Wool Yarn, Cloth	183 Man-Made Fibre	184 Twine & Cordage	185 Felt & Fibre	186 Carpet, Mat, Rug	187 Canvas Products	188 Auto. Fabric Acc.	189 Misc. Textile
Dummy Var. : >712	-1.326(2.5)	-2.310(5.3)	-.651(1.0)	-.025(.3)	.267(6.5)	.217(5.3)	.574(38.6)	-.053(1.3)	--
Observation : 302-310	-.038(.9)	-.085(2.5)	-.047) .9)	.059(.9)	-.072(2.6)	-.023(.8)	.056(5.5)	.085(3.0)	--
Is Unity : 156-224	-.058(2.1)	-.051(2.3)	_.027) .8)	-.022(.4)	.077(.3)	-.011(.5)	.018(2.2)	.006(.2)	--
If Pop. Of : 87-112	.031(1.6)	.026(1.7)	-.004(.2)	.004(.1)	.005(.3)	.005(.3)	.019(3.1)	-.043(2.3)	--
Largest : 57- 81	-.027(1.5)	-.023(1.5)	.027(1.2)	.081(2.2)	-.023(1.4)	.048)2.9)	.088(1.4)	.005(.3)	--
City In : 35-50	-.008(.4)	-.015(1.0)	.012(.5)	-.010(.2)	-.010(.6)	-.077) .4)	.014(2.2)	-.007(.4)	--
County, To : 24- 29	-.004(.2)	.016(1.0)	-.005(.2)	-.006(.2)	-.029(1.7)	.014(.8)	.004(.7)	.015(.9)	--
Nearest : 16- 20	-.034(1.4)	.022(1.1)	-.055(.2)	-.001(.0)	-.076(3.5)	-.006(.3)	.000(.0)	.006(.3)	--
Thousand Is : 10- 13	-.044(.2)	.012(.7_	-.006(.3)	.012(.3)	-.014(.7)	.025(1.3)	.003(.4)	-.002(.1)	--
Log 10 County Density	.020(2.1)	.006(.7)	.006(.5)	.026(1.4)	-.004(.4)	.018(2.1)	-.000(.1)	-.012(1.3)	--
Purchases From									
181 Cotton Yarn, Cloth	--	--	--	--	--	--	--	--	.141(3.5)
183 Man-Made Fibre	--	.194(1.8)	--	--	.187(1.5)	--	--	--	.045(1.1)
Supplies To									
182 Wool Yarn, Cloth	--	--	--	--	1.210(9.3)	--	--	--	--
188 Auto. Fabric Acc.	--	--	--	--	--	--	--	--	.020(.7)
239 Knitting	--	--	.268(1.1)	--	--	--	--	--	--
Clothing Princ. Comp.	1.870(2.4)	3.496(5.4)	.815(.8)	--	--	--	--	--	.702(37.7)
323-5 Motor Vehicle	--	--	--	--	--	--	--	1.427(9.2)	--
Constant	-.019(1.2)	-.013(1.0)	.022(.1)	-.036(1.1)	.007(.5)	-.023(1.7)	.000(.1)	.014(.9)	.022(.8)
R Squared	.4222	.6663	.1904	.2071	.8731	.6240	.9799	.7708	.9681
RBAR Squared	.2709	.5686	-.0465	.0227	.8360	.5365	.9752	.7108	.9655

was noted that Knitting Mills (239) are locationally backward linked to Man-made Fibre and Cloth Mills (183), which could not itself be locationally explained. Knitting Mills (239) were a significant locational factor for the Clothing Principal Component and for Men's Clothing Industries (243) in particular. Here we find that Man-made Fibre and Cloth Mills (183) is also a backward linkage locationally significant to Wool Yarn and Cloth Mills (182). Although there is an association between location and large city size, we find evidence that, other things being equal, large cities are avoided by firms in the textile industries. This is true of the Cotton Yarn and Cloth Mills (181), Wool Yarn and Cloth Mills (182), and the Automobile Fabric Accessories Industry (188) classifications.

The empiricial evidence suggests also that Man-made Fibre, Yarn and Cloth Mills (183) are least constrained locationally and yet play a key role particularly as a backward linkage to Knitting Mills (239), which in turn is a backward linkage for the Men's Clothing Industries (243), the Foundation Garment Industry (248), and the Clothing Principal Component.

Paper, printing and publishing

As with the clothing industries discussed above, we find a number of industries engaged in paper, printing and publishing activities whose percentage distribution among the countries is nearly identical. The correlation between the percentage employed in any two of S.I.C. 273, 274, 286, 288 or 289 is 0.96 or greater. These were, therefore, represented as a single composite - the Printing Principal Component. The manner of forming the composite is described in the introduction. Here we merely note that its correlation with any of the industries it represents is 0.984 or greater and that it has been adjusted so as to add to one in order for it to be comparable with other variables which are expressed as percentages. A discussion of the statistical aspects of the Printing Principal Component gives a preliminary summary of the five industries it represents.

The regression of city size and county density variables with Printing Principal Component as the dependent variable produces an almost perfect fit (RSQ* = 0.991). Logarithm county density is significant and positive. City size coefficients are positive and significant for city sizes I through IV and the coefficients rise with size of city class (0.013, 0.031, 0.031, 0.547). Percentage employment in Miscellaneous Services is an alternative

Table 3.6
Statistical results of regressions in the Paper, Printing and Publishing Industries

Dependent Variable: Counties' Proportion of Ontario Employment in Industry:

Independent Variables	271 Pulp & Paper Mill	272 Asphalt Roofing	273 Paper Box & Bag	274 Misc. Paper	286 Commerc. Printing	287 Plate - Making	288 Publish	289 Publish. & Printing	Printing Princ. Comp.
Dummy Var : >712	-.031(.9)	--	.449(25.3)	.578(32.8)	--	.194(4.1)	.709(87.4)	.045(1.3)	.547(63.0)
Observation : 302-310	-.016(.7)	--	.029(2.4)	.023(1.9)	--	.002(.5)	.022(3.9)	-.000(.1)	.031(5.3)
Is Unity : 156-224	-.025(1.4)	--	.042(4.2)	.033(3.3)	--	-.000(.1)	.018(3.8)	.009(2.6)	.031(6.3)
If Pop. Of : 87-112	.012(.8)	--	.014(1.9)	.011(1.6)	--	-.002(.7)	.009(2.7)	.006(2.2)	.013(3.5)
Largest : 57- 81	-.018(1.5)	--	.004(.5)	.008(1.1)	--	-.005(2.3)	.001(.2)	.002(1.0)	.004(1.3)
City In : 35- 50	-.001(.1)	--	.001(.1)	.002(.3)	--	.002(.8)	.007(1.9)	.002(1.5)	.005(1.2)
County, To : 24- 29	-.013(1.0)	--	.005(.7)	.001(.1)	--	-.003(1.6)	.002(.6)	.001(.7)	.003(.8)
Nearest : 16- 20	-.014(1.0)	--	.002(.2)	-.001(.2)	--	-.002(1.0)	.000(.0)	-.000(.3)	.002(.4)
Thousand Is : 10- 13	-.009(.7)	--	.001(.1)	.003(.4)	--	-.001(.6)	.002(.6)	.001(.5)	.002(.5)
Log 10 County Density	.025(2.3)	--	.007(1.9)	.007(2.0)	--	-.000(.4)	.004(2.2)	.001(1.6)	.005(2.8)
Purchases From									
Forestry Employment	1.192(7.4)	--	--	--	--	--	--	--	--
Supplies To									
Retail Trade	--	--	--	--	--	--	--	.213(1.4)	--
Misc. Services	--	--	--	--	1.143(58.8)	--	--	.593(5.2)	--
165 Plastics	--	1.010(8.2)	--	--	--	--	--	--	--
Printing Princ. Comp.	--	--	--	--	--	.892(10.3)	--	--	--
Constant	-.042(2.4)	-.000(.0)	-.008(1.3)	-.010(1.6)	-.003(2.1)	.000(.1)	-.005(1.8)	-.001(.7)	-.006(2.0)
R Squared	.8010	.5661	.9583	.9741	.9852	.9985	.9961	.9980	.9927
RBAR Squared	.7489	.5577	.9486	.9681	.9849	.9981	.9952	.9974	.9910

independent variable which also produces an excellent fit (RSQ* = 0.977) but is not significant (and hence does not add significantly to the variance of the independent variable) when regressed with city size and county density variables. We therefore conclude that the description in terms of city size and county density variables is the best statistically and percentage employment is considered market-oriented.

A distinction in the Standard Industrial Classification is made between Publishing Only (288) and Publishing and Printing (289). The description, just completed, of the independent variables significant in the regression for the Printing Principal Component would also fit Publishing Only (288), but not Publishing and Printing (289). Percentage employment in Miscellaneous Services is not a significant variable when regressed with city size and county density variables, although it is significant alone; city size and county density variables produce a better fit. A positive and significant coefficient for city sizes I to IV and for logarithm county density is obtained. This also fits well as description of percentage employment in Paper Box and Bag Manufacturers (273) and Miscellaneous Paper Converters (274) respectively. No supplier-purchaser classification could be identified. Logarithm county density is significant in these cases but city size class IV is not significant in the case of Miscellaneous Paper Converters (274). City coefficients rise with size of city in classes I, II, III and IV, indicating that these are activities confined to counties with larger cities.

In Commercial Printing (286), in Platemaking, Typesetting and Trade Bindery Industry (287), and in Publishing and Printing (289), purchasing industries prove statistically necessary. In the particular case of Commercial Printing (286), the best fit is obtained from percentage employment in Miscellaneous Services alone, but both sets of variables are needed in the explanation statistically best for the other two industrial classifications. In each case the appropriate F-test indicates that one set of variables is adding significantly to the variance explained by the other. In the Platemaking, Typsetting and Trade Bindery Industry (287), the Toronto county variable and the Printing Principal Component are significant and positive. The city size coefficients for city size V is negative and significant, indicating the Printing Principal Component would project a higher level than warranted for this size of city while underestimating Toronto county. There are two buyer classifications which potentially explain Publishing

and Printing (289): employment in Retail Trade and in Miscellaneous Services. When regressed with city size and county density variables, it is determined that the percentage employment in Miscellaneous Services and city sizes III and IV are the only significant variables.

The purchaser industry emerges much more clearly in the explanation of percentage employment in Asphalt Roofing Manufacturers (272). Percentage employment in the Plastics Fabricating Industry (165) as the single regressor is statistically significant. The city size and county density variables do not add significantly to this. Pulp and Paper Mills (271) is the only classification linked directly to a resource supplier. Percentage in Forestry Employment is significant when regressed with city size and county density variables, and adds significantly to the explained variance. The coefficient of logarithm county density is positive and significant, but none of the city size variables are significant and they tend to be negative.

The locations of industries in the printing and publishing portion of the S.I.C. are best explained by city size and county density variables. This was true of the aggregate which was called the Printing Principal Component, and of several of the specific classifications, including Publishing Only (288), Paper Box and Bag Manufacturers (273), and Miscellaneous Paper Converters (274). Sales to such industries link the Platemaking, Typsetting and Trade Bindery Industry (283) to the city, whereas with the location of Printing and Publishing (289), sales to Miscellaneous Services also plays a significant role. All of these classifications appear to be closely tied to the large cities and to the regional centre. Exactly the opposite is true of Pulp and Paper Mills (271), whose location is resource-determined. The location of Asphalt Roofing (272), on the other hand, is influenced by a supplier, the Plastics Fabricating Industry (165), whose location is significantly related to Man-made Fibre, Yarn and Cloth Mills (183). This classification was shown above to play a key role as a backward linkage for the textile and clothing industries.

Wood, furniture and fixtures

In the previous section the industries considered were, with two exceptions, oriented to population density and larger cities. In the set of industries which are to be described here there are three whose locations are explained solely by city size and county density. The locations of the

remainder are influenced by technological relationships, either through sales to the Construction industry, or by purchases from the Forestry industry.

The percentage employed in the Forestry industry was the only significant variable explaining the location of Sawmills, Planing Mills and Shingle Mills (251) or Veneer and Plywood Mills (252). It was also significant as an independent variable explaining employment in Miscellaneous Wood Industries (259), but Toronto county was also significant. The influence of Forestry employment on location seems to end at the earliest stages of processing. None of the three above industries is influential in the location of any later stages of processing.

At the other extreme there are three industries whose locations are explained solely by city size and county density. No suppliers or purchasers proved to be significant independent variables in the equations explaining employment in Wooden Box Factories (256), in the Coffin and Casket Industry (258), or in Household Furniture Manufacturers (261). The fit of city size and county density variables was weak in the regression for Wooden Box Factories (256). The only significant variables were logarithm county density and city size VII, which were positive. Percentage employment in Houshold Furuniture Manufacturers (261) can be explained by Toronto county and logarithm county density. A good fit is also obtained from city size and county density variables when percentage employment in the Coffin and Casket Industry (258) is the dependent variable. Toronto county is again significant, but in this case city sizes VII and IX are also significant. The statistical results indicate that Ontario's abundance of Forestry resources confers no locational advantage for these industries in the regions of supply.

A forward linkage to the Construction industry seems to influence the location of two industries. It was the only statistically significant factor influencing location of the Office Furniture Manufacturers (264). City size and county density variables did not add significantly to the explained variables. Location of Miscellaneous Furniture and Fixtures Manufacturers (266), on the other hand, must be explained with both Construction and city size and county density variables present. Of the city size and county density variables, only logarithm county density is significant singly. Firms forming the Miscellaneous Furniture and Fixtures Manufacturers (266) classification purchase in sufficient volume from Wire and

Table 3.7
Statistical results of regressions in the Wood and Furniture Industries

Independent Variables		251 Sawmills	252 Veneer + Plywood	254 Sash + Door	256 Wooden Box	258 Coffin + Casket	259 Misc. Wood	261 Household Furniture	264 Office Furniture	266 Misc. Furniture	268 Electric Lamp + Shade
		Dependent Variable: Counties' Proportion of Ontario Employment in Industry:									
Dummy Var.	: >712	--	--	.123(1.1)	.018(.6)	.353(11.1)	.015(3.1)	.339(13.6)	--	.390(4.8)	.586(19.7)
Observation	: 302-310	--	--	-.022(.9)	-.027(1.2)	.017(.7)	-.020(1.0)	-.004(.2)	--	-.029(1.6)	.002(.3)
Is Unity	: 156-224	--	--	.002(.1)	-.005(.3)	.004(.2)	-.015(.9)	.006(.4)	--	.005(.5)	-.002(4.2)
If Pop. of	: 87-112	--	--	.000(.0)	.014(1.1)	-.006(.4)	.107(1.2)	.018(1.8)	--	-.005(.6)	.002(.5)
Largest	: 57- 81	--	--	-.009(1.4)	.002(.2)	.018(1.4)	-.007(.6)	-.002(.2)	--	-.003(.6)	-.002(.6)
City In	: 35- 50	--	--	-.004(.6)	-.004(.3)	.007(.5)	-.101(.8)	-.005(.4)	--	-.000(.1)	.001(.4)
County, To	: 24- 29	--	--	-.008(1.3)	.050(3.7)	.042(3.1)	-.003(.3)	.010(.9)	--	-.006(1.2)	-.001(.1)
Nearest	: 16- 20	--	--	.008(1.1)	-.005(.3)	-.002(.1)	.026(1.9)	.023(1.8)	--	-.004(.8)	.000(.0)
Thousand Is	: 10- 13	--	--	-.006(.9)	.021(1.4)	.031(2.1)	-.009(.8)	.001(.1)	--	-.001(.3)	.000(.0)
Log 10 County Density		--	--	.005(1.6)	.021(3.2)	.009(1.5)	.013(1.2)	.009(1.8)	--	.002(.8)	-.000(.1)
Purchases From											
Forestry Employment		.469(6.3)	.789(7.5)	--	--	--	.368)2.4)	--	--	--	--
305 Wire and Products		--	--	--	--	--	--	--	--	.334(6.0)	--
333 Lighting Fixtures		--	--	--	--	--	--	--	--	--	.471(10.1)
Supplies To											
Construction		.010(.1)	--	.685(1.9)	--	--	--	--	.797(6.1)	.323(1.2)	--
336 Electr. Indus. Equip.		--	--	--	--	--	--	--	--	--	.016(.5)
Constant		.101(2.7)	.004(.9)	-.001(.3)	-.025(2.2)	-.013(1.2)	-.011(.7)	-.007(.8)	.004(.5)	-.002(.4)	.000(.0)
R Squared		.4342	.5225	.9529	.4465	.8267	.6256	.8745	.4159	.9904	.9971
RBAR Squared		.4120	.5134	.9405	.3177	.7865	.5275	.8454	.4047	.9875	.9963

Wire Products Manufacturers (305) to justify consideration of this as a potential locational factor, in addition to Construction. This is verified empirically, and it was found also that city size and county density variables added significantly to the explained variance, but that Construction did not. Only Toronto county and percentage employment in Wire and Wire Products Manufacturers (305) are significant.

Percentage employment in Electric Lamp and Shade Manufacturers (268) is significantly influenced by the supplier classification Manufacturers of Lighting Fixtures (333), but the relationship is not reciprocal (see below). Percentage employment in Manufacturers of Lighting Fixtures (333) is a significant independent variable when regressed with percentage employment in Manufacturers of Electrical Industrial Equipment (336) and with city size and county density variables. Of the city size and county density variables only Toronto county coefficient is significant.

Forestry employment has virtually no influence on the location of production beyond the earliest stage. The exception is found with Miscellaneous Wood Industries (259). Most production is influenced by either Toronto county, logarithm county density, or Construction employment.

Primary metal industry and metal fabricating

The industries under discussion in this section are involved in the processing of metals from the earliest stages on through to end products of various kinds. The resource basis for the sector is metal ore mining, which produces ingots in two primary stages of processing, recognized in the Standard Industrial Classification as Iron and Steel Mills (291) and Smelting and Refining (295). This latter classification is very well explained statistically by its backward linkage to mining and its forward linkage to Copper and Copper Alloy Rolling, Casting and Extruding (297). City size and county density variables cannot add significantly to this explanation. Mining is a locational factor establishing Smelting and Refining (295), but the sequence goes no further. In fact, it is the forward linkage to Copper and Copper Alloy Rolling, Casting and Extruding (297) that pulls Smelting and Refining (195) away from its resource base to locate in the market. Smelting and Refining (295) is not a locational factor for any other S.I.C. classification.

Potentially, Smelting and Refining (295) could be a locational factor

for Iron and Steel Mills (291), which is the second primary industry in the sector, but this is not the case. Instead, the location of the Iron and Steel Mills (291) classification is statistically explained by a forward linkage to the Metal Stamping, Pressing and Coating Industry (304) and by city size class II, which includes Hamilton. Negative coefficients indicate that any other city size is avoided. We interpret this result to mean that there are unique features of Hamilton (no doubt historical, in part) which single is out as the centre for such activity in Ontario. Unlike the activity of Smelting and Refining (295), the Iron and Steel Mills (291) classification is an important backward linkage for many other industries, bringing them near the location of the mills. However, in the next section we show that the Iron and Steel Mills (291) are not a locational factor for the transportation industries of Southern Ontario, and in the paragraphs below evidence is presented which suggests that, other things being equal, industries with backward linkages have not developed in Hamilton to the extent that would be expected, given the amount of Iron and Steel Mills (291) activity in that city.

Unlike the locational relationships between other industries, the relationship between Iron and Steel Mills (291) and the Metal Stamping, Pressing and Coating Industry (304) is reciprocal. When employment in the Metal Stamping, Pressing and Coating Industry (304) is the dependent variable, the percentage employed in Iron and Steel Mills (291) is a significant independent variable. The most successful regression includes city size and county density variables. Logarithm county density is statistically significant: employment rises with county density. Coefficients for city sizes over 87,000 have a positive and (except for size class 302,000 to 310,000 which includes Hamilton) significant effect on employment. Metal Stamping (304) is drawn towards larger cities and dense areas and, other things being equal, near Iron and Steel Mills (291).

Other industries for which Iron and Steel Mills (291) are a locational factor include S.I.C. 292, 302, 305, 206, 208 and 309. In the Hardware, Tool and Cutlery Manufacturers (306) regression, the percentage employment in Iron and Steel Mills (291) is the only significant independent variable, other than city size and county density. The rise in percentage employment with logarithm county density is significant and the positive coefficients attached to the city size variables for Class I and III are significant, indicating greater employment in counties with cities larger than 150,000 except in the case of city size II which includes Hamilton.

Table 3.8
Statistical results of regressions in the primary metals and metal fabricating industries

Independent Variables	Dependent Variable: Counties' Proportion of Ontario Employment In Industry: 291 Iron + Steel Mills	292 Steel Pipe, Tube	294 Iron Foundaries	295 Smelting + Refining	297 Copper Rolling	298 Metal Rolling	301 Boiler + Plate	302 Fabric. Struct. Metal
Dummy Var. : >712	-.957(4.5)	--	--	--	.424(20.0	.330(14.1)	-1.062(2.1)	.198(1.8)
Observation : 302-310	.155(3.3)	--	--	--	.011(.8)	.062(3.9)	-.285(2.3)	-.051(1.9)
Is Unity : 156-224	-.085(2.0)	--	--	--	.072(6.0)	.043(3.2)	-.136(2.1)	.006(.5)
If Pop. Of : 87-112	-.040(1.3)	--	--	--	.015(1.7)	.001(1.1)	-.011(.2)	.014(1.4)
Largest : 57- 81	.031(1.3)	--	--	--	.006(.7)	.003(.3)	-.043(1.4)	-.007(1.1)
City In : 35- 50	-.009(.4)	--	--	--	.018(1.9)	.017(1.7)	-.037(1.2)	.001(.1)
County, To : 24- 29	-.014(.5)	--	--	--	.004(.5)	.001(.1)	-.027(.9)	-.006(.9)
Nearest : 16- 20	-.003(.1)	--	--	--	.000(.0)	.014(1.2)	-.017(.5)	-.004(.6)
Thousand Is : 10- 13	-.031(1.1)	--	--	--	.001(.1)	.005(.5)	.004(.1)	.000(.0)
Log 10 County Density	-.037(2.5)	--	--	--	.005(1.2)	.005(1.1)	.026(1.9)	.003(1.0)
Purchases From								
Mining Employment	--	--	--	.879(14.2)	--	--	--	--
291 Iron + Steel Mills	--	.219(2.2)	--	--	--	--	.128(1.0)	.161(5.6)
Supplies To								
Construction	--	.271(1.6)	--	--	--	--	.3899(2.3)	.726(2.0)
Wholesale Trade	--	--	--	--	--	--	--	--
297 Copper Rolling	--	--	--	.175(2.7)	--	--	--	--
304 Metal Stamping	2.744(4.9)	--	--	--	--	--	--	--
323-5 Motor Vechile	.280(1.2)	--	.712(11.5)	--	--	--	--	--
Constant	.050(2.1)	.009(1.2)	.005(1.8)	-.001(.2)	-.007(1.0)	-.006(.7)	-.050(2.2)	-.005(1.1)
R Squared	.6373	.1499	.7182	.8087	.9363	.8837	.4691	.9719
RBAR Squared	.5312	.1165	.7128	.8012	.9215	.8567	.3138	.9637

Table 3.8 (continued)
Statistical results of regression in the primary metals and metal fabricating industries

Independent Variables	Dependent Variable: Counties' Proportion of Ontario Employment Industry: 303 Ornam. Metal	304 Metal Stamping	305 Wire and Products	306 Tool + Hardware	307 Heating Equipment	308 Machine Shops	309 Misc. Metal
Dummy Var. : >712	.464(40.2)	.353(26.2)	-.715(2.5)	.268(11.3)	.455(24.6)	-.305(3.2)	-.056(.4)
Observation : 302-310	.028(3.5)	.004(.3)	-.077(2.4)	-.003(.2)	-.008(.6)	-.055(5.5)	-.080(2.5)
Is Durty : 156-224	.060(9.2)	.023(3.1)	-.070(2.8)	.061(4.5)	.020(1.9)	-.040(4.2)	-.001(.1)
If Pop. Of : 87-112	.015(3.2)	.016(3.0)	-.011(.8)	.017(1.7)	.024(3.2)	-.004(.7)	-.001(.1)
Largest : 57- 81	.002(.4)	-.002(.4)	-.018(1.9)	.000(.0)	-.004(.6)	-.000(.0)	-.002(.2)
City In : 35- 50	.002(.5)	.003(.6)	-.023(2.3)	.009(.9)	.006(.7)	-.006(1.9)	-.002(.3)
County, To : 24- 29	.006(1.3)	.005(.9)	.002(.2)	.002(.2)	.001(.3)	-.000(.2)	.006(.8)
Nearest : 16- 20	-.002(.3)	.001(.2)	-.002(.2)	.005(.4)	.010(1.0)	-.003(.9)	-.001(.1)
Thousand Is : 10- 13	.000(.1)	.011(1.8)	-.002(.2)	.004(.4)	.007(.8)	-.001(.3)	.009(1.2)
Log 10 County Density	.006(2.3)	.012(4.3)	.013(2.8)	.011(2.2)	.012(3.2)	.003(2.1)	.015(4.4)
Purchases from							
Mining Employment	--	--	--	--	--	--	--
291 Iron + Steel Mills	--	.130(4.8)	.224(5.4)	.077(1.6)	--	.068(5.5)	.071(2.1)
Supplies To							
Construction	--	--	--	--	--	--	1.001(2.3)
Wholesale Trade	--	--	2.010(3.1)	--	--	1.451(6.7)	--
297 Copper Rolling	--	--	--	--	--	--	--
304 Metal Stamping	--	--	--	--	--	--	--
323-5 Motor Vehicle	--	--	--	--	--	.090(3.5)	--
Constant	-.007(1.7)	-.016(3.4)	-.019(2.7)	-.014(1.7)	-.016(2.5)	-.006(2.6)	-.024(4.1)
R Squared	.9831	.9672	.8674	.8603	.9583	.9924	.9192
RBAR Squared	.9791	.9586	.8286	.8237	.9486	.9899	.8956

In four cases the statistically significant independent variables include both the percentage employment in Iron and Steel Mills (291) and Construction. When percentage employment in Steel Pipe and Tube Mills (292) is the dependent variable, the city size and county density variables do not add significantly to the variance explained by Iron and Steel Mills (291) and Construction. The Fabricated Structural Metal Industry (302) also shows an affinity for locations near Iron and Steel Mills (291) and Construction. In this case, the Iron and Steel Mills (291) and Construction, and city size and county density variables, add significantly to the explained variance but no coefficient individually does so. Considering the signs and significance levels of the city size and county density variables, the statistical evidence favours Iron and Steel Mills (291) and Construction as the more important locational factor. Similar comments should be made concerning Miscellaneous Metal Fabricating Industries (309), except that there is a significant rise in the percentage of employment by county with logarithm county density, and the coefficient for city size 302,000 to 310,000 (which includes Hamilton) is significant and negative. Percentage employment in Iron and Steel Mills (291) is significant as is Construction.

The negative coefficient of city size II indicates that, although employment in Iron and Steel Mills (291) has an independent impact on Miscellaneous Metal Fabricating Industries (309), and although it is disproportionately located in Hamilton, the secondary industry is not established there.

To explain percentage employment in Wire and Wire Products Manufacturers (305) and Machine Shops (308), one must also make use of both sets of variables. Both the city size and county density variables and the supplier-purchaser variables are significant alone and add significantly to the variance when all variables are present. Significant coefficients imply that percentage employment rises with the logarithm of county density, and increases with the percentage employment in Iron and Steel Mills (291) or in Wholesale Trade. City sizes greater than 35,000 have negative effects which, except for size class IV and V, are significant. The statistical results indicate that the percentage employment in Machine Shops (308) can be explained exceedingly well by percentage employment in Iron and Steel Mills (291), in combination with percentage employment in Motor Vehicles and Parts (323, 325) and Wholesale Trade. Logarithm county density is

significant and positive, and city size coefficients are negative and significant for cities size I, II, III and VI, indicating that, for given levels of supplier-purchaser variables, the percentage employed increases with logarithm county density and falls with the size of the largest city in the county.

Percentage employed in Iron and Steel Mills (291) is not a significant independent variable explaining the location of employment in Boiler and Plate Works (301). But both supplier-purchaser and city size and county density add significantly to the explained variance. The logarithm county density carries a significant positive coefficient as does Construction. Given the levels of these two variables, employment in larger cities is avoided. Significant negative coefficients attach to city sizes I, II and III.

In two industries, Iron and Steel Mills (291) qualified as a potential locational factor because of its high volume of sales to a receiving industry, but the association did not prove itself statistically. The Ornamental and Architectural Metal Industry (303) is well explained by city size and county density variables. Percentage employment in Iron and Steel Mills (291) is significant by itself but not with city size and county density variables. The statistical evidence, therefore, implies that the location of this industry rises with logarithm county density, with positive effects for city sizes over 87,000. Similarly, employment of firms in the Heating Equipment Manufacturers (307) industry is well explained by city size and county density variables. Employment rises significantly with logarithm county density. Toronto county and city size IV are a significant locational factor; city size II, which includes Hamilton, is not significant.

Percentage employment in Iron Foundries (294) can be well explained by the single variable of percentage employment in Motor Vehicles and Parts (323, 325).

In the first paragraph of this section it was stated that, unlike Iron and Steel Mills (291), there was no statistical evidence that Smelting and Refining (295) activity had established industries backward linked to smelting and, in fact, examination of the regression for Smelting and Refining (295) indicates that this industry is itself influenced by forward linkages to locate away from the resource site, and more in the market where Copper and Copper Alloy Rolling, Casting and Extruding (297) is located. Employment in Copper and Copper Alloy Rolling, Casting and

Extruding (297) is explained quite well by city size and county density variables. Toronto and city size III carry significant positive coefficients. Percentage employment in Smelting and Refining (295) and percentage employment in Manufacturers of Electric Wire and Cable (338) did not prove significant. Similarly, percentage employment in Metal Rolling, Casting and Extruding (298) is best explained by city size and county density variables alone. Coefficients for city size classes 156,000 and over are positive and significant.

In the primary metals sector, Iron and Steel Mills (291) are a statistically significant variable establishing forward linkages locationally important to many other industries. Hamilton is well endowed with steel mills, but industries backward linked to steel are not as well established there as would be expected statistically. Smelting and Refining (295) does not establish backward linked industries, but rather is locationally influenced to locate at the site of the buyer.

Machinery (except electric) and transport equipment industries

The Machinery and Transport Equipment Industries represent later stages of processing which, unlike those discussed in the previous sections, would not be expected to make substantial purchases of output from Iron and Steel Mills (291). In fact, Iron and Steel Mills (291) are substantial supplies in only two cases, and a statistically significant locational variable in only one. Wholesale Trade and Iron and Steel Mills (291) are statistically significant independent variables in the regression which explains percentage employment in the Agricultural Implement Industry (311); Wholesale Trade is also a significant locational variable in two other industries. In Miscellaneous Machinery and Equipment Manufacturers (315) employment rises with logarithm county density and Wholesale Trade but, ceteris paribus, city size classes I, II and III (over 156,000) are avoided. The second industrial classification where Wholesale Trade emerges as a statistically significant variable is Office and Store Machinery Manufacturers (318). The market pull on this industry is indicated by the fact that Toronto county and Wholesale Trade are the only significant variables.

Ships and boats are described in two of the three digit codes of the Standard Industrial Classification. Shipbuilding and Repair (327) includes boats over 5 tons, while producers in the Boatbuilding and Repair (328)

Table 3.9
Statistical results of regressions in the machinery and transportation industries

Independent Variables	311 Agric. Implements	315 Misc. Machinery	316 Refrigt Air. Condit.	318 Office+ Store Mach.	321 Aircraft + Parts	323-5 Motor Vehicle	324 Truck Body+Trailer	326 Railroad Rolling Stk.	327 Ship-Building	328 Boat-Building	329 Misc. Vehicle
	Dependent Variable: Counties' Proportion of Ontario Employment in Industry:										
Dummy Var. : >712	--	-.523(2.8)	.124((2.3)	.403(4.1)	-.532(3.7)	.046(1.1)	.150(6.3)	.031(.4)	-1.396(2.9)	.045(1.7)	.410(9.7)
Observation : 302-310	--	.060(2.9)	-.009(.2)	-.001(.1)	-.144(5.8)	-.017(.6)	-.005(.3)	.273(5.2)	-.204(2.4)	-.019(1.1)	-.003(.1)
Is Unity : 156-224	--	-.042(2.5)	.053(1.7)	.003(.3)	-.072(3.2)	.083(3.5)	.056(4.1)	.052(1.2)	-.193(2.6)	-.011(.7)	.004(.2)
It Pop. Of : 87-112	--	-.009(1.0)	.007(.3)	.003(.7)	-.057)4.0)	.051(3.0)	.009(.9)	.026(.8)	-.037) .8)	.047(4.4)	.024(1.4)
Largest : 57- 81	--	-.001(.2)	.047(2.2)	-.004(1.2)	-.032(3.3)	-.006(.3)	.013(1.3)	-.001(.0)	-.043(1.3)	-.005(.5)	.001(.7)
City In : 35- 50	--	-.012(1.8)	-.002(.1)	.003(1.0)	-.031(2.7)	.002(.1)	.001(.1)	-.002(.0)	-.064(1.7)	.006(.5)	-.005(.3)
County, To : 24- 29	--	.012(1.8)	.014(.6)	-.004(1.1)	-.023(2.4)	.005(.3)	.017)1.6)	.010(.3)	.039(1.20	.005(.4)	.038(2.1)
Nearest : 16- 20	--	.002(.3)	.002(.1)	-.003(.8)	-.011(.9)	-.005(.2)	-.002(.2)	-.001(.0)	.006(.1)	.001(.1)	-.002(.1)
Thousand Is : 10- 13	--	.000(.1)	.005(.2)	-.002(.5)	-.003(.3)	.003(.2)	.007) .6)	.002(.1)	.002(.1)	.002(.2)	.003(.1)
Log 10 County Density	--	.008(2.7)	.018(1.6)	.002(1.3)	.017(3.5)	.017(2.0)	.012(2.4)	.002(.1)	.027)1.6)	.014(2.6)	.012(1.4)
Purchases From											
291 Iron + Steel Mills	.283(4.2)	--	--	--	--	--	--	--	--	--	--
Supplies To											
Transp. + Storage	--	--	--	--	2.985(7.2)	--	--	--	4.133(3.0)	--	--
Wholesale Trade	.464(5.6)	1.763(4.1)	--	.578(2.6)	--	--	--	--	--	--	--
Constant	.055(.9)	-.013(2.7)	-.025(1.3)	-.003(1.2)	-.032(3.7)	-.022(1.5)	-.012(1.5)	-.002(.1)	-.050(1.7)	-.012(1.3)	-.017(1.2)
R Squared	.5240	.9367	.3761	.9966	.9467	.5153	.7224	.4631	.3399	.5420	.7856
RBAR Squared	.5053	.9202	.2310	.9957	.9327	.4026	.6578	.3382	.1670	.4355	.7358

classification concentrate on smaller craft, including lifeboats, sailboats and motorboats. It was anticipated that the city size and county density variables considered in this study would not explain the percentage employment in Shipbuilding and Repair (327), and in fact this was the case. The effort to find a statistically satisfactory description was not successful, but it appears that employment in Transportation and Storage does have an influence and that, for a given level of this variable, cities under 156,000 would be preferred. In the regression in which percentage employment in Boatbuilding and Repair (328) was the dependent variable, the final regression explained more of the variation in the dependent variable. Percentage employment in Motor Vehicles and Parts (323, 325) is not a significant independent variable. Percentage employment in Boat-building and Repair (328) rises significantly with logarithm county density, and city size IV is significant.

Percentage employment in Aircraft and Aircraft Parts Manufacturers (321) is explained partly by percentage employment in Transportation and Trade. Logarithm county density also carries a positive and significant coefficient, while all city size variables are negative and, for city sizes greater than 24,000, significantly so. For any given level of employment in Transportation and Storage, employment rises with logarithm county density, but the greater the size of the city, the more this overstates the percentage employment in Aircraft and Aircraft Parts Manufacturers (321).

No dominant supplier or purchasing industries were found in the remaining classification, but city size and county density produced a reasonably good fit in two: Truck Body and Trailer Manufacturers (324) and Miscellaneous Vehicle Manufacturers (329). In both cases Toronto county was significant but, in the case of Truck Body and Trailer Manu-facturers (324), logarithm county density and city size III also carry positive and significant coefficients.

In three cases the explained variance is small, suggesting the need for additional variables not considered in this study. In the case of Motor Vehicles and Parts (323, 325), percentage employment in Iron and Steel Mills (291) was tried but was not significant. This regression indicates that employment rises with logarithm county density and that city sizes III and IV are significant. The classification Railroad Rolling Stock Industry (326) produces only RSQ* = .463 and, although the regression of city size and county density is significant, city size II is the only variable with a significant coefficient.

Except for the locational influence of Iron and Steel Mills (291) on the Agricultural Implement Industry (311), the locations of all industries in this sector are influenced by city size and county density variables, at least in part. The percentage of variance explained in the case of several industries is quite low: Commercial Refrigeration and Air Conditioning Equipment Manufacturers (316), Motor Vehicles and Parts (323, 325), the Railroad Rolling Stock Industry (326), and Shipbuilding and Repair (327).

Electrical products industries

The electrical products industries are locationally interconnected through forward and backward linkages. City size and county density are usually significant and usually indicate that the largest cities are preferred locations.

The Communications Equipment Manufacturers (335) classification is frequently found to attract industries to whom it sells. It is also attracted to one of the industries it supplies. This industry, Manufacturers of Household Radio and Television Receivers (334), is the only variable explaining the location of firms in the Communications Equipment Manufacturers (335) industry. The relationship is reciprocal. Manufacturers of Household Radio and Television Receivers (334) locate near producers of Communications Equipment Manufacturers (335). Toronto county is a positive and significant variable also, but city size II carries a significant negative coefficient. All of the other city sizes and county density variables fail this test of significance, and all city sizes save one have negative coefficients. The Communications Equipment Manufacturers (335) industry also influences location of the Manufacturers of Lighting Fixtures (333) and of the Manufacturers of Miscellaneous Electrical Products (339) although, in this case, county density and city size IV have a significant positive influence.

Major Appliances (332) locate near Iron and Steel Mills (291) but, ceteris paribus, Toronto county and city size III are significantly positive. Manufacturers of Small Electrical Appliances (331) are backward linked to the Metal Stamping, Pressing and Coating Industry (304). City size and county density variables do not add significantly to this, nor can they add to the variance explained in the case of the Manufacturers of Electrical Industrial Equipment (336), which locates through forward linkages to

Table 3.10
Statistical results of regressions in the electrical products industries

Dependent Variable: Counties' Proportion of Ontario Employment in Industry

Independent Variables	331 Small Elec. Appli.	332 Major Appliances	333 Lighting Fixtures	334 Radio + TV Receivers	335 Commun. Equipment	336 Electr. Indus. Equip.	338 Electr. Wire + Cable	339 Mis. Elect. Prod.
Dummy Var : >712	--	.266(7.3)	.470(9.6)	.185(2.8)	.119(3.5)	--	.346(11.6)	.336(7.7)
Observation : 302-310	--	.042(1.4)	-.030(1.5)	-.063)2.3)	.050(3.7)	--	-.007(.3)	-.021(1.6)
Is Unity : 156-224	--	.050(2.4)	.009(.5)	-.042(1.7)	.049(4.4)	--	-.010(.6)	.013(1.2)
If Pop. Of : 87-112	--	.011(.7)	.016(1.4)	.016(1.1)	.007(.9)	--	-.002(.2)	.017(2.5)
Largest : 57- 81	--	.016(1.1)	-.001(.1)	-.006(.4)	.003(.4)	--	.019(1.6)	-.002(.2)
City In : 35- 40	--	-.001(.0)	-.007(.6)	-.016(1.0)	.001(1.3)	--	.004(.3)	.002(.3)
County, To : 24- 29	--	-.000(.0)	-.006(.5)	-.010(.6)	.010(1.2)	--	-.003(.2)	.001(.2)
Nearest : 16- 20	--	-.002(.1)	-.015(1.0)	-.022(1.1)	.024(2.3)	--	.047) 3.1)	-.012(1.3)
Thousand Is : 10- 13	--	.001(.1)	-.000(.0)	-.005(.3)	.004(.5)	--	.027) 1.9)	.001(.1)
Log 10 County Density	--	.008(1.1)	.005(.9)	.008(1.0)	.004(1.1)	--	.010(1.7)	.009(2.5)
Purchases From								
291 Iron + Steel Mills	--	.179(2.4)	--	--	--	--	--	--
298 Metal Rolling	--	--	--	--	--	--	--	.061(.6)
304 Metal Stamping	.856(10.7)	--	--	--	--	--	--	--
335 Commun. Equipment	--	--	.523(2.9)	.922(3.7)	--	--	--	.285(2.6)
Supplies To								
315 Misc. Machinery	--	--	--	--	--	1.112(12.1)	--	--
334 Radio + TV Receivers	--	--	--	--	.266(3.7)	--	--	--
336 Electr. Indus. Equip.	.151(1.8)	--	--	--	--	--	--	--
Constant	-.000(.1)	-.011(.9)	-.008(.9)	-.008(.6)	-.006(.8)	-.002(.5)	-.011(1.1)	-.011(1.9)
R Squared	.8927	.7408	.9470	.8399	.8670	.7368	.8407	.9649
RBAR Squared	.8885	.6729	.9332	.7980	.8322	.7317	.8037	.9546

Miscellaneous Machinery and Equipment Manufacturers (315). The location of Manufacturers of Electric Wire and Cable (338) could be explained by the percentage employment in Copper and Copper Alloy Rolling, Casting and Extruding (297), but better results are obtained from city size and county density variables with Copper and Copper Alloy Rolling, Casting and Extruding (297) excluded. As with the other industries considered in this section, Toronto county is the dominant independent variable.

Non-metallic mineral products industries

Forward linkages dominate the non-metallic mineral products sector of the Standard Industrial Classification. All but three industries locate near an industrial buyer. In two of the three industries where the industrial linkage fails, the city and county density variables fail as well and, therefore, no satisfactory explanation can be found for the location of Abrasives Manufacturers (357) or Lime Manufacturers (358). This is possibly because suitable resource variables were not available.

In the third industry where linkages variables failed, Miscellaneous Non-Metallic Mineral Products Industries (359), the city size and county density variables were successful. Logarithm county density, the Toronto county variable, and the coefficient for city size V were positive and significant. Linkage variables also fail to exceed the threshold of significance in the case of Stone Products Manufacturers (353). For these firms the statistical evidence also favours city size and county density variables alone. Asphalt Roofing Manufacturers (272) is a potential independent variable but is not significant when the city size and county density variables are present. Logarithm county density and coefficients for city sizes I and II (over 302,000) are significant and positive. Two industries, Concrete Products Manufacturers (354) and Ready-Mix Concrete Manufacturers (355) are backward linked to the supplier industry, Cement Manufacturers (352), and forward linked to the purchasing industry, Construction. City size and county density variables do not add significantly to the variance explained by the supplier-purchaser variables in the case of percentage employment in Ready-Mix Concrete Manufacturers (355). When percentage employment in Concrete Products Manufacturers (354) is the dependent variable, city size and county density variables do

Table 3.11
Statistical results of regressions in the non-metallic mineral products industries

Independent Variable	351 Clay Products	353 Cement Manufacture	353 Stone Products	354 Concrete Products	355 Ready-Mix Concrete	356 Glass + Products	357 Abrasive	358 Lime Manufacture	359 Misc. Non-Met. Min.
	Dependent Variable: Counties' Proportion of Ontario Employment In Industry:								
Dummy Var. : >712	.061(.3)	--	.229(8.1)	.023(.3)	--	.280(9.9)	-.065(.7)	-.044(.5)	.204(6.6)
Observation : 301-310	.031(.6)	--	.049(2.5)	-.008(.4)	--	.054(2.8)	.001(.0)	-.011(.2)	.004(.2)
Is Unity : 156-224	.027(1.0)	--	.002(.1)	.017(1.7)	--	.016(.9)	-.028) .5)	-.020(.4)	-.000(.0)
If Pop. Of : 87-112	.025(1.2)	--	.020(1.7)	.011(1.4)	--	.004(.3)	.089(2.2)	.010(.3)	.017(1.3)
Largest : 56- 81	.007(.5)	--	-.007(.6)	-.003(.6)	--	-.003(.3)	-.001(.0)	.043(1.1)	.032(2.6)
City In : 35- 50	.002(.2)	--	.002(.2)	.012(2.4)	--	.018(1.5)	-.014(.3)	-.008(.2)	-.009(.7)
County, To : 24- 29	.008(.6)	--	.003(.2)	-.000(.1)	--	.004(.4)	.011(.3)	.107(2.7)	-.005(.4)
Nearest : 16- 20	.000(.0)	--	-.009(.6)	.000(.0)	--	.013(.9)	.004(.1)	-.004(.1)	-.009(.6)
Thousand Is : 10- 13	.002(.2)	--	-.003(.2)	.003(.5)	--	-.001(.1)	.007(.2)	.004(.1)	.003(.2)
Log 10 County Density	.014(2.5)	--	.015(2.5)	.005(2.1)	--	.007(1.1)	.033(1.6)	.017(.9)	.014(2.2)
Purchases From									
312 Cement Manufacture	--	--	--	.110(2.6)	.051(1.1)	--	--	--	--
Supplies To									
Construction	.204(.3)	--	--	.685(2.5)	.911(23.7)	--	--	--	--
323-5 Motor Vehicle	--	--	--	--	--	.162(1.6)	--	--	--
354 Concrete Products	--	.510(4.5)	--	--	--	--	--	--	--
Constant	-.019(1.8)	.009(1.9)	-.014(1.4)	-.008(2.1)	.001(.4)	-.007(.7)	-.047(1.4)	-.025(.7)	-.013(1.3)
R Squared	.6359	.2792	.7743	.9560	.9337	.8225	.2096	.1937	.7021
RBAR Squared	.5405	.2653	.7218	.9431	.9311	.7760	.0258	.0061	.6328

add significantly to the explained variance. In all, there are four significant independent variables: percentage employment in Construction and in Cement Manufacturers (352), and logarithm county density and city size VI, 35,000 to 50,000.

The relationship between Concrete Products Manufacturers (354) and Cement Manufacturers is reciprocal. The percentage employment in Concrete Products Manufacturers (354), in the role of an independent variable, is significant in regressions where Cement Manufacturers (352) is the dependent variable. The city size and county density variables do not add to the variance explained by percentage employment in Concrete Products Manufacturers (354). This latter industrial classification, therefore, is an important locational factor but, because of the low value of RSQ*, other variables are obviously needed to explain the dependent variable.

In the remaining three industrial classifications location is significantly affected by a single purchasing industry. Percentage employment in Motor Vehicles and Parts (323, 325), with city size and county density variables, is a significant variable explaining the location of Glass and Glass Products Manufacturers (356). City sizes I and II are also significant independent variables.

Percentage employment by county in Clay Products Manufacturers (351) can be explained by Construction. This variable is significant regressed alone but not when regressed with the city size and county density variables. The latter are jointly significant but do not add significantly to the variance explained by Construction. When the city size and county density variables are the only independent variables, we find that employment rises with logarithm county density, and the coefficients for city sizes I, II, III and IV (cities over 87,000) are positive and significant. Although the city size coefficients are no longer significant in the regression with all variables present, they are of the same sign and approximate magnitude. With either alternative the same conclusion stands: that Clay Products Manufacturers (351) tend to locate at the market.

Petroleum and coal products industries

No significant supplier purchaser variables were found to explain location of Petroleum Refineries (365) but the city size and county density variables are jointly significant. Logarithm county density is not significant, but

Table 1.12
Statistical results of regressions in the petroleum and coal products industries

Independent Variables		365 Petrol.	369 Misc. Petrol.+Coal	372 Mixed Fertilizer	373 Plastic+ Synth. Resin	374 Pharm.+ Medicines	375 Paint+ Varnish	376 Soap+ Cleaning	377 Toilet Preparations	378 Indust. Chemical	379 Misc Chemical
		Dependent Variable: Counties' Proportion of Ontario Employment in Industry:									
Dummy Var	: >712	.358(6.6)	.246(5.8)	--	--	.495(29.3)	.324(2.2)	.258(.6)	.052(.3)	.074(1.2)	--
Observation	: 302-310	.000(.0)	.071(3.4)	--	--	-.003(.3)	-.015(.9)	.076(1.7)	-.050(1.7)	-.008(.2)	--
Is Unity	: 156-224	.020(.7)	-.002(.1)	--	--	.048(4.9)	.028)2.1)	-.014(.4)	-.025(1.5)	.009(.3)	--
If Pop. Of	: 87-112	.014(.6)	.035(2.8)	--	--	.006(.9)	.007)1.0)	.002(.1)	-.014(1.3)	.023(.9)	--
Largest	: 57- 81	.048)2.2)	-.009(.7)	--	--	-.000(.0)	-.001(.2)	-.003(.2)	-.013(.6)	.051(2.1)	--
City In	: 35- 50	-.000(.0)	.012(.9)	--	--	.015(2.1)	.001(.1)	-.005(.3)	.007(.8)	-.001(.0)	--
County, To	: 24- 29	-.002(.1)	.004(.3)	--	--	.004(.6)	-.003(.6)	-.003(.2)	.001(.1)	-.006(.2)	--
Nearest	: 16- 20	-.002(.1)	-.003(.2)	--	--	.011(1.3)	-.002(.3)	-.003(.2)	-.011(1.0)	.006(.2)	--
Thousand Is	: 10- 13	.002(.1)	.003(.2)	--	--	.001(.1)	.000(.1)	-.000(.0)	-.003(.3)	.001(.0)	--
Log 10 County Density		.010(.9)	.014(2.3)	--	--	.007(2.2)	.006(2.6)	.006(.9)	.005(1.1)	.014(1.1)	--
Purchases From											
Misc. Services		--	--	--	-	--	--	--	1.176(2.7)	--	--
365 Petrol.		--	.134(1.6)	--	--	--	--	--	--	--	--
378 Indust. Chemical		--	--	.511(9.0)	.250(4.0)	--	--	--	--	--	--
Supplies To											
Improved Land (Acres)		--	--	.969(4.8)	--	--	--	--	--	--	--
Wholesale Trade		--	--	-.000(.0)	--	--	.513(1.5)	.640(.7)	--	--	.968(31.3)
365 Plastics		--	--	--	.550(8.9)	--	--	--	--	--	--
Constant		-.014(.7)	-.020(1.9)	-.009(1.9)	.004(1.1)	-.009(1.6)	-.009(2.4)	-.010(.9)	-.006(.9)	-.016(.7)	.001(.3)
R Squared		.6348	.8325	.7221	.7033	.9684	.9895	.9247	.9692	.2330	.9485
RBAR Squared		.5498	.7886	.7055	.6917	.9611	.9868	.9050	.9612	.0423	.9485

Toronto county and city size 57,000 to 81,000 (which includes Sarnia) carry significant positive coefficients. Since these are the counties which receive stocks of crude petroleum by pipeline, it may be assumed that such deliveries are the locational factor. The presence of Petroleum Refineries (365) is a factor influencing the location of Miscellaneous Petroleum and Coal Products Industries (369). Firms in this classification specialize in asphalt, coke and tar products. The city size and county density variables add significantly to the variance explained by Petroleum Refineries (365): Employment rises significantly with logarithm county density, and city sizes, I, II and IV carry significant coefficients.

There are a number of complex linkages among the industries related to Manufacturers of Plastics and Synthetic Resins (373). This industry is not itself locally linked to Petroleum Refineries (365) but in the discussion relating to the tobacco, rubber and leather sector it was found that the Manufacturers of Plastics and Synthetic Resins (373) classification is a significant backward linkage influencing the location of the Plastics Fabricating Industry (165). This relationship is now seen to be reciprocal. The Plastics Fabricating Industry (165) also has a statistically significant backward linkage to the Manufacturers of Plastics and Synthetic Resins (373). Furthermore, the Manufacturers of Industrial Chemicals (378) classification is a statistically significant forward linkage. The Industrial Chemicals (328) classification is also a statistically significant backward linkage for Manufacturers of Mixed Fertilizers (323), for which there is, additionally, a statistically significant forward linkage: Improved Land. City size and county density variables add nothing statistically to this explanation. Although Manufacturers of Industrial Chemicals (378) are a locational factor in the above two industries, the relationship is not reciprocal, and no linkage variable could be found to explain the location of this industry. City size and county density variables also failed to be significant.

In the regressions relating to Manufacturers of Pharmaceuticals and Medicines (374), city size and county density variables by themselves produce the best fit. Employment rises with logarithm county density and city sizes I and III are significant. This is true when we look at city size and county density variables alone, but with Miscellaneous Services present logarithm county density is no longer significant. Miscellaneous Services is a significant variable explaining percentage employment in Manufacturers

of Toilet Preparations (377). None of the city size or county density variables is individually significant. The greater the percentage employment in Manufacturers of Toilet Preparations (377), the greater is the relative magnitude of Miscellaneous Services.

As a single independent variable, Wholesale Trade can explain a large proportion of the variance in the percentage of employment in either Paint and Varnish Manufacturers (375) or in Manufacturers of Soap and Cleaning Compounds (376). This variable fails to be significant, however, when city size and county density variables are present. In the case of Paint and Varnish Manufacturers (375), the coefficient for logarithm county density and city sizes I, III and IV are significant. Manufacturers of Soap and Cleaning Compounds (376) could be explained by Wholesale Trade. The city size and county density variables do not add to the variance explained by Wholesale Trade however, and since Wholesale Trade is not significant when city size and county density variables are present, the statistical evidence does not distinguish between the two possibilities. Nevertheless, we may conclude that percentage employment in Manufacturers of Soap and Cleaning Compounds (376) is market-oriented. With the description offered by the city size and county density variables alone, we conclude that city sizes I and II are statistically significant.

A similar conclusion is reached when the evidence relating to the firms in Miscellaneous Chemical Industries (379) is examined. The results obtained from the city size and county density variables alone indicate that city size III and especially Toronto county have independent impact. These variables produce an extremely close fit (RSQ* = 0.949). One must conclude that employment is market-oriented. This is corroborated by the fact that Wholesale Trade alone can produce an alternate description (RSQ* = 0.949). However, it is not significant when regressed with the city size and county density variables, and these latter do not add significantly to the variance explained by Wholesale Trade. In either case it is clear that location is determined by factors affecting selling opportunities.

This is not the case for Manufacturers of Industrial Chemicals (378). Percentage employment by county could not be explained by supplier or purchaser variables. The city size and county density variables produce only RSQ* = 0.0432. This result is below the threshold considered significant.

Miscellaneous manufacturing industries

City size and county density variables play an important role in all five of the remaining industries. In three classifications, supplier-type variables are significant alone but are not significant in regressions where city size and county density variables are present. These latter produce an excellent fit and add significantly to the variance explained by supplier-type variables.

Percentage employment in Scientific and Professional Equipment Industries (391) can be well described by percentage employment in Education, which is significant regressed alone but not when regressed with city size and county density variables. The city size and county density varaibles also produce a good fit and significantly add to the variance explained by percentage employment in Education. The regression including only these variables is therefore preferred. There is special impact in Toronto and city size class II but no other variable is significant, nor is the coefficient attached to logarithm county density. Similarly, percentage employment in Smelting and Refining (295) is a significant variable explaining percentage employment in the Jewellery and Silverware Industry (392), but by itself it can explain only 5.4 per cent of the variance (RSQ), and it is not significant when used in combination with city size and county density variables.

These latter produce an excellent fit and add significantly to the explained variance when Smelting and Refining (295) is present. Percentage employment rises with logarithm county density, and city sizes class III and Toronto county are significant. In the case of Miscellaneous Manufacturing (399), a satisfactory explanation can be obtained using the purchaser variable, employment in Miscellaneous Textiles Industries (189), and the supplier variable Wholesale Trade (RSQ* = 0.96). However, in the regression in which all variables are present, neither the supplier-purchaser variables nor the city size variables add significantly to the explained variance. Percentage employment in Miscellaneous Manufacturing Industries (399) may be explained either by the percentage employment in Wholesale Trade and Miscellaneous Textile Industries (189), or by logarithm county density, Toronto county and city size IV.

Input-output relationships indicated that percentage employment in the Signs and Displays Industry (397) might be explained by percentage

Table 3.13
Statistical results of regressions in the Miscellaneous Manufacturing Industries

Independent Variables		391 Scient. Prof. Equip.	392 Jewellery	393 Toy & Sporting	397 Signs Display	399 Misc. Manufact.
		Dependent Variable: Counties' Proportion of Ontario Employment in Industry:				
Dummy Var	>712	.474(25.1)	.683(63.2)	.564(30.4)	.643(64.6)	.164(.9)
Observation	302-310	.059(4.6)	.006(.9)	-.006(.5)	.028(4.1)	-.001(.5)
Is Unity	156-224	.022(2.0)	.014(2.3)	.013(1.2)	.031(5.5)	-.003(.2)
If Pop. Of	87-112	.007(1.0)	.008(1.8)	.016(2.1)	.009(2.3)	.005(.5)
Largest	57- 81	.005(.7)	-.001(.3)	.011(1.5)	.002(.8)	-.006(.9)
City In	35- 50	.010(1.3)	.009(1.9)	.004(.6)	.011(2.6)	.006(.8)
County, To	24- 29	.011(1.4)	.000(.1)	.004(.5)	.003(.8)	-.003(.5)
Nearest	16- 20	-.000(.0)	-.003(.5)	-.001(.1)	-.000(.0)	-.004(.6)
Thousand Is	10- 13	-.000(.0)	.003(.6)	.004(.4)	.001(.2)	.001(.1)
Log 10 County Density		.004(1.1)	.004(1.9)	.010(2.7)	.003(1.4)	.009(2.8)
Purchases From						
Wholesale Trade	--	--	--	--	--	.530(1.2)
Supplies To						
189 Misc. Textile		--	--	--	--	.038(.3)
Constant		-.005(.7)	-.004(1.1)	-.014(2.2)	-.004(1.2)	-.010(2.0)
R Squared		.9563	.9926	.9705	.9929	.9720
RBAR Squared		.9461	.9909	.9636	.9912	.9638

employment in Veneer and Plywood Mills (252), but this did not prove to be significant alone or in conjunction with city size and county density variables. These latter, fitted alone, did produce an excellent fit (RSQ* = 0.991). City sizes I, II, III, IV and VI were significant.

No supplier-purchaser variable was found for the Sporting Goods and Toy Industries (393). City size and county density variables were successful alone however; Toronto county, city size III and logarithm county density were significant.

Summary and conclusions

It has been the objective in this Chapter to explain the location of industries or, more accurately, of the percentage of total Ontario employment in each of 110 industries in each of 54 counties. The success of the project can be judged in terms of the success of predicting the locations of each industry. As a measure of success for an individual equation, one can take the percentage of the variance of the dependent variable which is explained by the independent variables in the regression equation. This should take account of the number of variables needed in the equation, and so one usually adjusts for the number of "degrees of freedom".

Table 3.1 displays the frequency distribution of RSQ*, which is the percentage of explained variance in the dependent variable adjusted for degrees of freedom. With forty degrees of freedom, a value of thirty per cent or less would be expected with a probability of five per cent and, therefore, one might measure success as the ratio of those over thirty per cent to the total number (98/110 = 0.891) or one might call attention to the fact that RSQ* > 0.90 in 44 cases out of 110. In the author's judgment, from any point of view Table 3.1 indicates extensive regularity in the locations of manufacturing industries.

There are twelve cases where the level of RSQ was too low to be significant, and another three cases where the level of RSQ is so low as to be barely over the arbitrarily set threshold of significance. Although such industries have technological linkages to other industries through purchases or sales of intermediate goods, such linkages do not determine their locations, nor do characteristics of larger cities, nor population density per se. In some of these cases better data or microeconomic studies may uncover additional features which could not be considered in a

comprehensive study of this kind. Thus in the non-metallic minerals part of the S.I.C. better results might have been obtained for Cement Manufacturers (352), Lime Manufacturers (358) and Abrasives Manufacturers (357), if we had better resource data.

For other industries, it is not obviously the case that better data would bring better results. These industries, though technologically connected, seem to be locationally unconnected to the economic structure of Ontario, and it is possible to set up the hypothesis, subject to confirmation through microeconomic studies, that relocation to areas of chronically high unemployment is possible at moderate cost. In this chapter a number of industries have been identified for future research. Of the fifteen or so which are poorly explained, some are important to the establishment of an industrial base and others are not. There were no forward or backward linkages, for example, in the case of Leather Glove Factories (1975) or the Cordage and Twine Industry (184).

On the other hand, there are a number of industries whose location is not explained but which play a significant role in explaining the location of others. Through forward or backward linkages they establish the industrial base in the regions where they locate and, as a further hypothesis, may have the capability of establishing an industrial base in places to which they are moved.

The statistical results indicate that Ontario's Iron and Steel Mills (291) have played a key role in establishing other industries through logical linkages. Although technological linkages have created locational linkages in this case, such is not an inevitable outcome. This was amply illustrated by the Smelting and Refining Industry (295), which has established no statistically significant locational impact through forward linkages, and which seems, rather, itself to be drawn into the Toronto region through forward linkages. Even in the case of the Iron and Steel Mills (291), there were many instances where forward linkages failed to establish nearby industry and, in fact, the industrial structure of Hamilton fails to reach the level statistically expected in many cases. This would be true, for example, of the Fabricated Structural Metal Industry (302), of the Hardware, Tool and Cutlery Manufacturers (306), of the Heating Equipment Manufacturers (307) and of the Miscellaneous Metal Fabricating Industries (309).

Tobacco and Forestry are the most notable in their failure to generate

forward linkages. For this reason it is of interest to know whether or not expansion of Wooden Box Factories (256) or Household Furniture Manufacturers (261) is possible in the north or east. This is a consideration for the next chapter.

In addition to the Iron and Steel Mills (291) mentioned above, there were a number of industries which, although beyond the resource stage, nevertheless were influential in the locations of rated industries. Statistical evidence indicates that Man-made Fibre, Yarn and Cloth Mills (183) are a backward linkage locationally for Knitting Mills (239), and both produce backward linkages locationally for other industries in the knitting mills and clothing sector. Man-made Fibre, Yarn and Cloth Mills (183) are a backward linkage also for Wool Yarn and Cloth Mills (182), and for the Rubber Products Industries (162). Other types of locational interdependence were discussed. Manufacturers of Plastics and Synthetic Resins (373) are locationally linked to the Plastics Products Industry (165), and the latter is also linked to the former. The Plastics Products Industry (165) is also backward linked to Manufacturers of Industrial Chemicals (378), to which Manufacturers of Mixed Fertilizers (372) are also linked. This illustrates but does not exhaust the list of such industries, which will be considered further in the discussion of regions in the next chapter.

The Motor Vehicle and Parts (323, 325) classification is second only to the Iron and Steel Mills (291) in the frequency with which it appears as a significant variable explaining the location of other industries. Although there are technological linkages to Ontario's economic structure, the statistical analysis of Chapter III indicates that such linkages cannot explain the location of the industry, nor can it be explained by characteristics of Ontario's cities. Because of the large volume exported, the Ontario market itself is a factor of limited value. The importance to Ontario of the Motor Vehicle and Parts (323, 325) industry represents the greatest point of vulnerability in the provincial economy because of its weak locational ties here.

CHAPTER FOUR

TRADE AND PRODUCTION OF ONTARIO'S REGIONS

In this chapter the locational factors influencing Ontario's industries are compared to similar features of Ontario's regions. The objective is to provide guidelines for public policy related to questions of regional development. This is achieved first by consideration of the points of strength in the more prosperous central regions, and secondly by noting lines of potential growth for the outlying regions. It is assumed that industries which are well integrated in the central regions, according to the statistical analysis of Chapter Three, would be least likely to prosper in the outlying regions. On the other hand, the statistical analysis of Chapter Three does reveal characteristics of each industry which account for location. Statements concerning the suitability of a given industry to a given region are possible by comparing characteristics of the former to the latter.

This chapter begins with a general description of the resource and population characteristics of Ontario and its regions. There follows a discussion of the regions, including a summary relating to policy considerations and, at the end of the chapter, a summary relating to all of Ontario.

The analysis of Chapter Three indicated that in many industries population density was itself a locational factor. Table 4.1 demonstrates the variability of density by county and by region in Ontario. In this respect Toronto county is unique, being nearly ten times more dense than its nearest rival, Wentworth county; Toronto region is three times as dense as Kitchener/Hamilton/St. Catharines. At the other extreme we may contrast the sparse population of Northwestern Ontario (density = 1.11 per sq. mile) to that of Toronto region (density = 916.24 per sq. mile). It is obvious that market-oriented industries will prefer the southern regions of Toronto and Kitchener/Hamilton/St. Catharines to the Northwest, and that Toronto county has a unique role to play in the economic structure of Ontario.

The resource endowment of Ontario relative to Canada is indicated by the first column in the upper portion of Table 4.2. The figures in this table are ratios (Ontario to Canada) of employment, acreage of value, and

TABLE 4.1
Ontario regional definitions, populations and densities, 1971

	Population	Area	Density
North-West Ontario	224370.	201994.	1.11
Kenora	53230.	153220.	.35
Rainy River	25750.	6493.	3.97
Thunder Bay	145390.	42281.	3.44
North-East Ontario	582379.	111178.	5.24
Algoma	121937.	19771.	6.17
Cochrane	95836.	55584.	1.72
Manitoulin	10931.	1421.	7.69
Nipissing	78867.	7022.	11.23
Parry Sound	30244.	3815.	7.93
Sudbury	198079.	17715.	11.18
Timiskaming	46485.	5850.	7.95
Lake Huron/Bruce	229712.	5462.	42.06
Bruce	47385.	1563.	30.32
Grey	66403.	1739.	38.18
Huron	52951.	1314.	40.30
Perth	62973.	846.	74.44
Central Ontario	403860.	8648.	46.70
Dufferin	21200.	575.	36.87
Haliburton	9081.	1610.	5.64
Muskoka	31938.	1558.	20.50
Northumberland	48162.	737.	65.35
Peterborough	87804.	1394.	62.99
Simcoe	171433.	1704.	100.61
Victoria	4242.	1070.	32.00
Eastern Ontario	1070916.	13837.	77.40
Dundas	17457.	393.	44.42
Frontenac	101692.	1475.	68.94
Glengarry	18480.	481.	38.42
Grenville	24316.	462.	52.63
Hastings	99393.	2304.	43.14
Lanark	42259.	1183.	35.72
Leeds	50093.	847.	59.14
Lennox, Addington	28359.	1097.	25.85
Ottawa-Carleton	471931.	1065.	443.13
Prescott	27832.	480.	57.98
Prince Edward	20640.	405.	50.96
Renfrew	90875.	2952.	30.78
Russell	16287.	293.	55.59
Stormont	61302.	400.	153.26
Toronto Region	2945699.	3215.	916.24
Durham	47494.	619.	76.73
Halton	190469.	380.	501.23

TABLE 4.1
Ontario regional definitions, populations and densities, 1971

	Population	Area	Density
Ontario	196257.	833.	235.60
Peel	259402.	463.	560.26
Toronto	2086017.	242.	8619.90
York	166060.	678.	244.93
Lake St. Clair	521831.	2839.	183.81
Essex	306399.	719.	426.15
Kent	101118.	963.	105.00
Lambton	114314.	1157.	98.00
London/Lake Erie	428971.	2806.	152.88
Elgin	66608.	726.	91.75
Middlesex	282014.	1298.	217.27
Oxford	80349.	782.	102.75
Kitchener/Hamilton/St. Catharines	1295368.	4244.	305.22
Brant	96767.	422.	229.31
Haldimand	32673.	484.	67.51
Niagara	347328.	715.	485.77
Norfolk	54099.	642.	84.27
Waterloo	254017.	513.	495.20
Wellington	108581.	1026.	105.83
Wentworth	401883.	442.	909.24

SOURCE: Statistics Canada (92-741, 1975)

livestock. Rankings for each column are shown in parentheses. The cut-off ratio for defining resource abundance in Ontario relative to Canada is indicated by the 1971 ratio of Ontario GNP to Canadian GNP (approximately 0.42). In the nine columns to the right of column one, the ratios and ranking are given for the regions relative to Ontario. The table therefore gives a general description of the relative abundance of resources in Ontario to Canada in the upper portion, and their distribution in Ontario in the lower part. One limitation to the interpretation of this table in describing resource abundance is that several of the resources considered are based on employment and value rather than on direct comparisons of resource stock, and several categories overlap.

Although, when measured in terms of population or income, Ontario is the largest province of Canada, the ratios in the first column of Table 4.2 indicate that it is less well endowed in the resources which characterize the rest of Canada - mining, forestry and fishing. Ontario

Table 4.2
Ontario regional shares of Ontario and Canadian agriculture and resources

Name of Resource	Ontario	Northwest Ontario	Northeast Ontario	Lake Huron/ Bruce	Central Ontario	Eastern Ontario	Toronto Region	Lake St. Clair	London/ Lake Erie	Kitchener/ Hamilton/ St. Catharines
Share of Canadian										
1. Agriculture Employment	.272(5)	.003(4)	.007(4)	.040(3)	.025(4)	.045(2)	.029(3)	.029(3)	.036(2)	.058(4)
2. Fisheries Employment	.052(9)	.009(3)	.004(5)	.003(8)	.004(9)	.003(9)	.006(8)	.014(6)	.003(8)	.008(7)
3. Mining Employment	.300(4)	.029(2)	.210(1)	.003(6)	.006(7)	.008(7)	.027(4)	.006(8)	.003(7)	.008(8)
4. Forestry Employment	.121(7)	.046(1)	.047(2)	.001(9)	.005(8)	.014(6)	.003(9)	.001(9)	.001(9)	.003(9)
5. Fruit Trees Acreage	.467(3)	.000(8)	.000(9)	.048(2)	.036(1)	.026(4)	.050(2)	.053(2)	.029(4)	.225(2)
6. Small Fruits Acreage	.487(2)	.000(9)	.001(8)	.003(7)	.010(6)	.008(8)	.015(5)	.009(7)	.006(6)	.435(1)
7. Field Crops Acreage	.112(8)	.001(6)	.004(6)	.020(5)	.011(5)	.020(5)	.008(7)	.016(4)	.014(5)	.017(6)
8. Vegetables Acreage	.497(1)	.001(7)	.002(7)	.026(4)	.029(3)	.043(3)	0.53(1)	.171(1)	.086(1)	.087(3)
9. Value of Livestock	.256(6)	.003(5)	.007(3)	.059(1)	.031(2)	.050(1)	.022(5)	.015(5)	.030(3)	.039(5)
Share of Ontario										
1. Agriculture Employment	1.000	.010(5)	.026(6)	.148(3)	.092(3)	.165(3)	.106(4)	.108(5)	.131(2)	.214(3)
2. Fisheries Employment	1.000	.165(2)	.080(3)	.052(5)	.080(4)	.060(6)	.112(1)	.261(2)	.048(6)	.153(6)

Table 4.2
Ontario regional shares of Ontario and Canadian agriculture and resources (continued)

Name of Resource	Ontario	Northwest Ontario	Northeast Ontario	Lake Huron/ Bruce	Central Ontario	Eastern Ontario	Toronto Region	Lake St. Clair	London/ Lake Erie	Kitchener/ Hamilton/ St. Catharines
3. Mining Employment	1.000	.097(3)	.702(1)	.010(8)	.020(8)	.027(8)	.089(5)	.019(8)	.009(9)	.026(8)
4. Forestry Employment	1.000	.383(1)	.384(2)	.012(7)	.038(7)	.115(4)	.024(9)	.004(9)	.011(8)	.025(9)
5. Fruit Trees Acreage	1.000	.000(8)	.001(9)	.103(4)	.007(5)	.056(7)	.107(2)	.113(4)	.061(5)	.483(2)
6. Small Fruits Acreage	1.000	.000(9)	.003(8)	.006(9)	.020(9)	.016(9)	.030(8)	.019(7)	.012(7)	.894(1)
7. Field Crops Acreage	1.000	.012(4)	.037(4)	.175(2)	.098(2)	.183(2)	.074(7)	.147(3)	.122(3)	.152(7)
8. Vegetables Acreage	1.000	.001(7)	.004(7)	.051(6)	.059(6)	.087(5)	.107(3)	.344(1)	.173(1)	.174(4)
9. Value of Livestock	1.000	.010(6)	.029(5)	.230(1)	.120(1)	.197(1)	.086(6)	.058(6)	.117(4)	.154(5)

SOURCE: Statistics Canada (94-741, 1975; 96-707, 1973)

agriculture also differs from the rest of Canada by being much more specialized in fruits and vegetables, relative to grains. Thus agricultural policy appropriate for Ontario is likely to involve considerations which are different from those appropriate for Canada as a whole (see Williams, 1976, 65-6). The upper portion of Table 4.2 indicates also that no region resembles Ontario as a whole in terms of the rankings of its resources relative to all of Canada. The rankings of the ratios in the columns on the right are quite different from the ranking in column one. Thus the economic base for each of the regions is quite different from every other, and the appropriate strategy for economic development will therefore differ by region.

There are many differences among the regions which prevent us from thinking of Ontario as a homogeneous unit, but there are also notable similarities between some of them. These are more easily seen in the lower half of Table 4.2, where the regional shares of the Ontario total are shown. A ranking of the resource shares of each region indicates that the Northwestern and Northeastern regions are most similar. The Northwestern and Northeastern regions, with their specialization in fishing, forestry and mining, are also most similar to Canada as a whole. Also very similar in the ranking of their resource shares are the Lake Huron/Bruce, Central Ontario, and Eastern Ontario regions which, except for acreage committed to vegetables and fruits, appear to be the agricultural base of Ontario. The Lake Huron/Bruce, St. Clair and London/Lake Erie regions specilize in vegetables and field crops, while relative to Ontario as a whole the Kitchener/Hamilton/St. Catharines region is most specialized in acreage committed to fruit trees and small fruits.

More details about the specific resource base of the regions can be inferred from the net trade of the regions presented in Table 4.3. Net trade (exports less imports) is expressed in millions of tons. If there is no inventory accumulation and no error in measuring commodity trade, and if consumption and production methods are similar from region to region, it can be inferred that a region is specialized in any commodity of which it is a net exporter. In Table 4.3 this interpretation is subject to one other limitation. Although the data include all forms of transport including truck, rail and ship, they exclude pipelines. Crude oil, therefore, can be brought into Toronto by pipeline unrecorded, only to appear as an export in truck, rail or ship data. With these limitations in mind, and those described in Chapter Two, Table 4.3 showing net trade in resources by

Table 4.3
Net exports of resources of nine Ontario regions in millions of tons, 1975

Citn No.	Name of Resource	Northwestern Ontario	Northeastern Ontario	Lake Huron Bruce	Central Ontario	Eastern Ontario	Toronto Region	Lake St. Clair	London Lake Erie	Kitchener/ Hamilton/ St. Catharines
25	Alumina and Bauxite Ore	-.001848	-.001891	-.000039	0.000000	-.001997	-.011761	.000678	-.001084	-.039483
26	Copper Ore and Concentrates	.196044	-.190622	0.000000	0.000000	.000000	-.000065	0.000000	0.000000	.000073
27	Iron Ore and Concentrates	4.321218	2.763484	0.000000	.002928	.371354	-.001167	-.034997	0.000000	-7.454206
28	Nickel-Copper and Concentrates	.130646	-.042499	0.000000	.000620	0.000000	.005195	-.000036	0.000000	-.071199
29	Lead and Zinc Ores and Concentrates	.351582	.384268	0.000000	0.000000	.000072	-.000048	-.022260	0.000000	-.033699
30	Other ores and Concentrates	.000027	-.004252	-.001091	-.001047	-.000117	-.003559	.000076	-.000159	-.003213
38	Crude Asbestos	0.000000	.012381	-.000036	-.000175	-.000532	-.022105	-.010903	-.000071	-.013323
39	Sand and Gravel	-.000955	-.002042	-.037868	.597192	-.379997	-.904266	-.004115	.211683	-.280726
40	Crude Gypsum	.000075	0.000000	-.026377	.000105	-.062830	-.000112	0.000000	-.000433	-.033706
41	Phosphate Rock	0.000000	0.000000	-.000182	0.000000	0.000000	-.001987	-.00091	-.000153	.000148
42	Salt	-.078303	-.139934	2.018434	-.000455	-.206312	-.204371	.445230	-.001492	-.001503
43	Potash	-.000328	-.015356	-.026651	-.012947	-.025525	-.007117	-.017045	-.059099	-.035672
44	Sulphate	-.076915	-.099884	-.000090	0.000000	-.016703	-.002243	.001252	0.000000	-.055791
45	Other Mine Prod.	-.054555	-.011651	-.033300	4.142026	.201387	-4.041839	-.085683	.371124	.619228
33	Coal	-.142310	-.051061	-.002793	-.001412	-.118142	-.027664	-.017236	-.110475	-.631783
34	Crude Petroleum, and Natural Gas	0.000000	-.000006	0.000000	0.000000	0.000000	.157466	-.001006	.001012	.000026
35	Other Bituminous Substances	-.001357	-.000491	0.000000	0.000000	-.000026	-.001301	.000057	0.000000	-.000265

Table 4.3
Net exports of resources of nine Ontario regions in millions of tons, 1975 (continued)

Cttu No.	Name of Resource	Northwestern Ontario	Northeastern Ontario	Lake Huron Bruce	Central Ontario	Eastern Ontario	Toronto Region	Lake St. Clair	London Lake Erie	Kitchener/ Hamilton/ St. Catharines
36	Natural Gas and Lng	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
6	Wheat	-.567477	-.004279	-.070877	-.185407	-.072125	-.250032	.336358	0.41582	-.278501
7	Other Grain	-.211818	-.018444	.014052	-.031321	-.222801	-.169296	.249757	.054986	.139125
11	Potatoes	-.000242	-.007603	-.000421	-.022148	-.025872	-.078498	-.004942	-.002523	-.012119
17	Tobacco	-.000000	-.000011	.000551	.000082	.000100	-.009781	.000293	.006577	-.000087
19	Oil Seeds	-.000478	0.000000	-.000014	-.000071	-.000632	-.136788	.089542	.014352	-.009599
22	Pulpwood Logs and Chips	-.103305	.470496	-.000153	.011111	.011997	0.001975	+.000000	-.000207	-.394468
23	Forest Products, Logs and Poles	.001546	.053002	-.003371	-.001450	-.057048	-.003810	-.001340	-.001733	-.004708
4	Fish and Marine Animals Nes	-.000784	-.000334	-.000019	-.000162	-.002536	-.005423	-.000489	-.000054	-.001776
71	Iron and Steel and their Alloys	-.012837	1.041568	-.029097	-.032543	-.114838	-.140808	-.272287	-.020888	1.327266
81	Machinery & Parts	-.002197	-.001675	.005337	.006223	-.007691	.001922	-.000274	.006012	.021821
82	Agricultural Machinery & Parts	.002750	-.002216	-.002206	-.001251	-.002045	-.008131	.018240	.002638	.132990
83	Passenger Automobiles	-.006189	-.000039	-.000033	.000002	-.000117	.234557	.303371	.031090	-.017342
84	Freight Automobiles and Buses	-.006128	-.001419	.004101	.000370	-.000295	.387681	.042320	.005779	.005376
85	Vehicle Parts	-.001598	-.001967	.192689	.006193	.000205	-.857487	.342348	.025851	.224306
86	Other Vehicles	.000847	-.006651	-.000907	.000907	-.001509	-.000402	.000290	.012349	.006374
87	Other Manufacturing Equipment	-.003155	-.001442	.017300	.002360	.001232	.059903	-.000539	.004993	.064340
72	Aluminum & Alloys	-.000171	-.000128	-.000186	.000254	-.065600	-.031249	-.006881	-.000070	.006351

Table 4.3
Net exports of resources of nine Ontario regions in millions of tons, 1975 (continued)

Citu No.	Name of Resource	Northwestern Ontario	Northeastern Ontario	Lake Huron Bruce	Central Ontario	Eastern Ontario	Toronto Region	Lake St. Clair	London Lake Erie	Kitchener/ Hamilton/ St. Catharines
73	Copper and Alloys	.004336	.150682	-.000209	.000001	-.018245	.001961	-.001037	-.012222	-.010220
74	Nonferrous Metal Nes and Alloys	.000093	.097989	-.000981	-.000837	-.004485	-.065630	-.006747	-.000168	-.065032
75	Metal Fabricating Basic Products	.000861	-.000655	-.001800	.000226	.001373	.022731	-.000249	-.000220	.033475
77	Cement, Natural and Portland	-.028521	-.162172	.058170	.002321	1.051880	-.015357	-.051258	-.087651	-.002761
78	Non-Metallic and Mineral Products	-.021873	-.044662	.010843	.237104	-.015593	.006832	.020819	.252508	-.092313
65	Gasoline	-.294605	-.686330	-.040081	-.014472	-.094538	.259329	.972460	-.026393	-.000946
66	Fuel Oil	-.495880	-1.211497	-.346605	-.010716	-.930636	.356765	2.312617	-.080956	-.463328
67	Coke	-.000061	-.095451	-.001073	-.002971	-.004190	-.008915	-.016396	.002855	.050185
68	Petroleum Gas Liquified	-.013753	-.055138	-.010957	-.007148	-.024208	-.029081	.078365	-.010102	-.015115
69	Refined Petroleum	-.047424	-.037295	-.001902	-.014884	-.033351	-.274198	.154035	-.048916	.098123
1	Live Animals	.000902	-.001000	-.022163	-.009505	-.003194	-.067491	-.011868	-.020811	-.007624
2	Fresh and Frozen Meat	-.007339	-.019836	.003486	.000017	-.001834	-.015197	-.000013	.000165	.000399
3	Meat Nes	-.000006	-.000490	-.000035	-.000001	-.000693	.027993	-.000000	-.000001	.000666
5	Dairy Produce Eggs and Honey	-.000549	-.001690	.000967	.000218	.021405	-.006405	-.000036	.010905	.001765
8	Wheat Flour	-.049199	-.003064	.005313	.024561	.000006	.035872	.007106	.006853	.089812
9	Cereal Products	.126045	-.002335	-.001001	.014658	-.004204	-.004825	-.000790	.065693	-.006525
10	Fresh & Frozen Fruits	-.001112	-.002155	-.001001	-.000089	-.008746	-.111126	-.001350	-.002792	-.010879
12	Other Vegetables Fresh and Frozen	.002492	-.000219	-.001153	-.000062	-.006291	-.090495	.003880	.000970	-.003857

Table 4.3
Net exports of resources of nine Ontario regions in millions of tons, 1975 (continued)

Cftn No.	Name of Resource	Northwestern Ontario	Northeastern Ontario	Lake Huron Bruce	Central Ontario	Eastern Ontario	Toronto Region	Lake St. Clair	London Lake Erie	Kitchener/ Hamilton/ St. Catharines
13	Sugar and Molasses	-.002504	-.000452	-.000307	-.032497	-.034197	-.159186	-.015008	-.005862	-.005524
14	All Other Food Products Nes	-.008570	-.006126	.028752	.037143	.023064	.154642	.126903	.068457	.125479
15	Fodder and Feed	.400322	-.046850	-.062361	.041426	-.004858	.151207	.033166	.020065	.120441
16	Beverages	-.045754	-.013098	-.000296	.001902	.000107	.019477	.008175	-.001560	.005148
20	Crude Animal and Vegetable Product	-.000386	-.000885	-.001342	-.009631	-.011142	-.024222	.015547	-.001628	-.036415
49	Oils, Fats, Waxes	.013674	-.005948	-.000923	-.001607	.003447	-.029928	-.000765	-.001122	-.003695
50	Fabricated Vegetable Materials	-.000217	.001631	-.000075	.031160	.000458	-.012220	-.000296	.000267	.004179
52	Lumber Including Flooring	.085731	.001272	-.056615	-.041790	-.07969	-.307236	-.036756	-.046731	-.186598
53	Plywood & Veneer	.041083	-.022975	-.016524	-.018119	-.037603	-.164022	-.009270	-.031157	-.054739
54	Other Fabricated Wood Products	-.001940	-.005195	-.000155	-.010168	-.004585	-.011909	-.005509	-.003670	-.013765
55	Wood Pulp	.596276	.128807	0.000000	-.009549	-.036865	-.069373	-.054179	-.061797	-.093117
56	Newspaper Print	.628743	.182665	-.005636	-.001849	-.002213	-.190584	-.055321	-.097191	-.046416
58	Paper Board Pulp-Board, Fiberboard	.109523	.016241	-.021804	-.008539	-.012954	-.262120	-.004744	-.068171	-.116154
57	Paper Other Than Newsprint	.060602	.000856	-.006681	-.008795	.011251	-.129009	-.008931	-.006889	-.019290
60	Sulphuric Acid	-.010611	.452020	0.000000	-.002883	-.003941	-.015380	-.158297	0.000000	-.219862
61	Chemicals	-.169350	-.113364	-.027027	-.028278	-.208478	-.296338	1.286426	-.027482	-.057556
62	Fertilizers (Excluding Potash)	-.009723	-.041048	-.004739	-.010399	.059095	-.011182	.062919	-.037842	.169079
63	Chemical Products	-.004577	.000783	-.002482	-.021788	.012343	-.040980	.117840	-.003801	-.012461

Ontario's regions can be used to study regional specialization in production.

The trade figures indicate in more detail than in Table 4.3 the kinds of mining which are characteristic of the Northwestern and Northeastern regions. Some resources are, by implication, scarce. Alumina and bauxite ore are imported into both regions, and both regions must import minerals such as sand, gravel, salt, potash, sulphur, coal, and other bituminous substances. They both export iron and zinc concentrates but only the Northwestern region exports copper ore. These exports from the Northwestern region are, in fact, about equal to the amount imported into the Northeastern region. Nickel-copper ores and concentrates are also exported from the Northwest and imported in the Northeastern region. In this case the exports of the Northwestern region are about equal to the combined imports of the Northeastern region plus the amount imported into the Kitchener/Hamilton/St. Catharines region. Forestry resources are more significant in the exports of the Northeastern region than of the Northwestern region. Pulpwood is actually imported into the Northwest, but the main destination is the Kitchener/Hamilton/St. Catharines region. The Eastern region imports forest products, logs and poles in about the same magnitude that they are exported from Northwestern Ontario.

The similarities in the resource base of the Lake Huron/Bruce, Central Ontario and Eastern Ontario regions were noted in terms of aggregated data above. Thi is also revealed in the more disaggregated trade data. When one region has net exports of a particular resource this tends to be true of other regions as well, indicating that they are similarly specialized in production. There are exceptions. Compared to the other two, the Lake Huron/Bruce region is distinctive in that it alone has net exports of salt, other crude mine products (clay, crude refractory materials, abrasives and crude stone) and other grains. Central Ontario differs from the other two in that it has a net export of sand and gravel and crude gypsum.

With a few exceptions, the remaining regions are importers or at least no exporters of resources. Sand and gravel are exported from the London/ Lake Erie region, and apparently pipeline arrivals of crude petroleum and natural gas are exported from the Toronto region. There are no resources for which there is a net export from all nine regions in Ontario, although there are a few, e.g. potash, coal and potatoes, for which there

were net imports in all regions. This reinforces the conclusion above, based on aggregated data, that the relationship between resources and trade in Ontario must be pursued on a regional rather than on a province-wide basis.

Production and trade in terms of regional characteristics

In order to describe conditions in production in Ontario's regions, a series of five table were prepared. The discussion of the nine regions that follows focuses on manufacturing. Table A4.1 in the appendix is presented in order to put this into perspective. Manufacturing accounted for only 26 per cent of total employment in 1971. Services of all types, by contrast, accounted for 53 per cent of employment. Both the Toronto and London/ Lake Erie regions have greater shares of Ontario's service employment than they do of her manufacturing employment.

The shares of the regions are shown in Table A4.2 in the appendix. Toronto's share of Ontario employment in finance, insurance and real estate is 57.3 per cent, while her share in manufacturing is 44.2 per cent. The Toronto regional share of all employment is 41.0 per cent. The share in manufacturing employment exceeds this by 3.1 per cent (after rounding) and the share of finance, insurance and real estate exceeds it by 16.3 per cent. These facts are presented in Table A4.3 in the appendix, with rankings shown in parentheses. Toronto's share of manufacturing is 5th ranked of all those compared. Tables 4.4 and 4.5 present similar data for manufacturing only. In Table 4.4 it can be verified that the Toronto region has 50.2 per cent of all employment in Meat and Poultry Products (101) and from Table 4.5 it is seen that this is 9.0 points greater than Toronto's share of all employment (=41.0 from Table A4.2). Whenever an item in Table A4.3 or Table 4.5 appears with a positive sign, it means that the region's share is greater than the region's share of all employment in the case of Table A4.3, or of manufacturing employment in the case of Table 4.5, and it is called a specialization of the region. Toronto is specialized in finances, insurance and real estate and in Meat and Poultry Products (101). The 1970 Standard Industrial Classification number is shown in parentheses.

The Toronto region

The economics and regional science literature describes the forces which

Table 4.4
Proportion of Ontario employment in each of nine regions - 110 industries, 1971

S.I.C.	Name of Industry	Northwest Ontario	Northeast Ontario	Lake Huron/ Bruce	Central Ontario	Eastern Ontario	Toronto Region	Lake St. Clair	London/ Lake Erie	Kitchener/ Hamilton/ St. Catharines
101	Meat & Poultry Products	.003	.003	.041	.019	.017	.502	.033	.052	.330
102	Fish Products	.068	.000	.000	.000	.023	.120	.684	.000	.105
103	Fruit & Vegetables	.001	.001	.071	.041	.044	.230	.315	.027	.271
104	Dairy Products	.029	.057	.055	.053	.198	.247	.056	.099	.206
105	Flour and Breakfast Cereal	.011	.004	.017	.156	.029	.255	.018	.299	.211
106	Feed	.014	.003	.159	.106	.146	.169	.057	.130	.215
107	Bakery Products	.017	.045	.024	.034	.088	.490	.038	.091	.173
108	Miscellaneous Food Products	.016	.005	.004	.080	.108	.582	.017	.046	.141
109	Beverage	.018	.042	.021	.024	.092	.389	.151	.113	.150
151	Leaf Tobacco Processors	.000	.000	.000	.000	.000	.000	.514	.224	.262
153	Tobacco Products	.000	.000	.000	.013	.015	.505	.047	.055	.365
162	Rubber Products	.000	.002	.041	.063	.017	.391	.011	.060	.415
165	Plastics Fabricating	.001	.002	.019	.111	.038	.557	.068	.027	.178
172	Leather Tanneries	.000	.000	.004	.231	.054	.595	.000	.002	.113
174	Shoe Factories	.000	.001	.040	.039	.152	.325	.012	.081	.350
175	Leather Glove Factories	.000	.000	.031	.000	.123	.215	.000	.000	.631
179	Luggage, Handbags, Small Lth.	.000	.000	.069	.023	.110	.537	.009	.016	.236
181	Cotton Yarn, Cloth Mills	.000	.000	.003	.004	.213	.059	.000	.061	.660
182	Wool Yarn, Cloth Mills	.000	.000	.169	.021	.155	.131	.000	.018	.506
183	Man-made Fibre Yarn, Cloth	.000	.010	.001	.040	.631	.048	.001	.048	.220
184	Cordage and Twine	.000	.000	.027	.000	.041	.055	.014	.027	.836
185	Felt and Fibre Mills	.000	.000	.021	.000	.086	.429	.000	.000	.464
186	Carpet, Mat, Rug Industry	.000	.000	.000	.271	.055	.303	.002	.007	.362

Table 4.4
Proportion of Ontario employment in each of nine regions - 110 industries, 1971 (continued)

S.I.C.	Name of Industry	Northwest Ontario	Northeast Ontario	Lake Huron/ Bruce	Central Ontario	Eastern Ontario	Toronto Region	Lake St. Clair	London/ Lake Erie	Kitchener/ Hamilton/ St. Catharines
187	Canvas Prod., Cotton, Jute	.054	.018	.000	.036	.032	.638	.043	.025	.154
188	Auto Fabric Accessories	.000	.000	.017	.109	.000	.251	.424	.006	.194
189	Miscellaneous Textile	.002	.005	.056	.030	.064	.558	.009	.024	.252
231	Hosiery Mills	.000	.000	.020	.000	.037	.516	.000	.303	.124
239	Knitting (Excluding Hosiery)	.000	.001	.036	.012	.066	.387	.000	.133	.365
243	Men's Clothing	.011	.000	.014	.007	.079	.529	.003	.010	.346
244	Women's Clothing	.002	.001	.001	.013	.049	.837	.003	.063	.032
245	Children's Clothing	.000	.000	.000	.000	.032	.740	.037	.000	.192
246	Fur Goods	.008	.008	.000	.023	.000	.908	.000	.000	.054
248	Foundation Garments	.000	.005	.000	.000	.407	.563	.000	.005	.020
249	Miscellaneous Clothing	.004	.008	.008	.000	.101	.586	.042	.004	.245
251	Sawmills, Planing, Shingles	.102	.420	.067	.100	.199	.035	.017	.017	.044
252	Veneer and Plywood Mills	.132	.484	.026	.057	.168	.031	.000	.057	.044
254	Sash, Door, Other Millwork	.013	.052	.088	.024	.127	.470	.016	.073	.136
256	Wooden Box Factories	.000	.005	.027	.024	.032	.244	.135	.284	.249
258	Coffin and Casket Factories	.000	.000	.029	.159	.029	.406	.014	.174	.188
259	Miscellaneous Wood Industries	.145	.112	.107	.099	.122	.221	.020	.051	.124
261	Household Furniture Manuf.	.001	.011	.208	.041	.050	.466	.021	.038	.165
264	Office Furniture Manuf.	.000	.000	.011	.051	.122	.498	.002	.006	.310
266	Misc. Furniture, Fixtures	.001	.012	.011	.020	.071	.670	.027	.035	.154
268	Electric Lamp and Shade	.000	.000	.000	.000	.000	.988	.000	.000	.012

Table 4.4
Proportion of Ontario employment in each of nine regions - 110 industries, 1971 (continued)

S.I.C.	Name of Industry	Northwest Ontario	Northeast Ontario	Lake Huron/ Bruce	Central Ontario	Eastern Ontario	Toronto Region	Lake St. Clair	London/ Lake Erie	Kitchener/ Hamilton/ St. Catharines
271	Pulp and Paper Mills	.376	.247	.009	.007	.154	.058	.000	.003	.146
272	Asphalt Roofing	.000	.000	.000	.000	.000	.722	.019	.000	.259
273	Paper Box and Bag	.000	.000	.017	.038	.039	.645	.011	.114	.136
274	Miscellaneous Paper Converters	.003	.001	.008	.032	.020	.793	.008	.014	.121
286	Commercial Printing	.002	.010	.027	.024	.106	.667	.020	.059	.084
287	Platemaking, Typesetting	.000	.000	.004	.003	.033	.834	.022	.036	.068
288	Publishing Only	.006	.004	.005	.012	.034	.839	.014	.025	.061
289	Publishing and Printing	.022	.046	.026	.036	.118	.507	.058	.053	.135
293	Iron and Steel Mills	.000	.215	.001	.015	.004	.126	.006	.003	.629
292	Steel Pipe and Tube Mills	.002	.233	.000	.003	.003	.229	.008	.227	.295
294	Iron Foundries	.003	.034	.011	.011	.054	.258	.293	.036	.301
295	Smelting, Refining (+Alum.)	.000	.465	.000	.017	.155	.194	.009	.005	.155
297	Copper Rolling, Casting etc.	.000	.044	.002	.020	.012	.644	.020	.113	.145
298	Metal Rolling, Casting etc.	.000	.010	.002	.038	.120	.469	.086	.059	.217
301	Boiler and Plate Works	.000	.001	.018	.010	.033	.232	.016	.018	.671
302	Fab. Structural Metal Ind.	.035	.049	.007	.020	.050	.553.	.057	.028	.203
303	Ornam., Architech. Metal Ind.	.002	.010	.012	.018	.045	.655	.031	.119	.109
304	Metal Stamping, Coating etc.	.004	.003	.011	.039	.035	.539	.060	.038	.272
305	Wire and Wire Products	.002	.001	.041	.027	.065	.331	.043	.050	.439
306	Hardware, Tool, Cutlery	.000	.004	.035	.035	.039	.438	.198	.032	.239
307	Heating Equipment Manufacturing	.002	.000	.012	.026	.049	.666	.043	.019	.183
308	Machine Shops	.016	.043	.019	.044	.053	.488	.062	.045	.230
309	Misc. Metal Fabricating	.001	.004	.018	.086	.039	.404	.129	.039	.281

Table 4.4
Proportion of Ontario employment in each of nine regions - 110 industries, 1971 (continued)

S.I.C.	Name of Industry	Northwest Ontario	Northeast Ontario	Lake Huron/ Bruce	Central Ontario	Eastern Ontario	Toronto Region	Lake St. Clair	London/ Lake Erie	Kitchener/ Hamilton/ St. Catharines
311	Agricultural Implements	.002	.000	.011	.039	.004	.299	.016	.045	.585
315	Misc. Machinery, Equipment	.003	.019	.058	.101	.039	.408	.012	.098	.241
316	Commercial Refrigeration	.000	.000	.002	.093	.042	.342	.011	.108	.402
318	Office and Store Machinery	.006	.012	.001	.008	.062	.792	.029	.027	.063
321	Aircraft and Parts	.049	.000	.002	.032	.028	.826	.003	.003	.058
323	Motor Vehicle and Parts	.001	.003	.024	.020	.005	.376	.303	.070	.199
324	Truck Body and Trailer	.017	.007	.102	.040	.028	.324	.090	.174	.218
326	Railroad Rolling Stock	.074	.002	.000	.005	.000	.113	.016	.200	.591
327	Shipbuilding and Repair	.148	.000	.079	.371	.010	.038	.010	.000	.344
328	Boat Building and Repair	.012	.099	.059	.136	.090	.253	.040	.031	.281
329	Misc. Vehcile Manufacturers	.000	.000	.000	.280	.027	.480	.000	.040	.173
331	Small Electrical Appliances	.003	.006	.006	.182	.046	.504	.005.	.028	.221
332	Major Appliances	.000	.002	.002	.016	.029	.373	.003	.151	.424
333	Lighting Fixtures	.000	.000	.000	.007	.004	.908	.000	.031	.050
334	Household Radio-TV Receivers	.000	.001	.005	.032	.119	.553	.001	.007	.282
335	Communications Equipment	.001	.003	.013	.072	.214	.453	.003	.079	.161
336	Electrical Industrial Equip.	.001	.001	.018	.234	.025	.398	.011	.047	.265
338	Electric Wire and Cable	.000	.000	.001	.145	.213	.440	.000	.014	.186
339	Misc. Electrical Products	.000	.000	.011	.019	.045	.696	.015	.095	.120
351	Clay Products	.007	.005	.046	.051	.118	.366	.044	.046	.317
352	Cement Manufacturers	.007	.014	.121	.028	.312	.337	.004	.110	.067
353	Stone Products	.000	.000	.000	.091	.091	.576	.000	.045	.197
354	Concrete Products	.024	.038	.029	.035	.117	.444	.039	.088	.186

Table 4.4
Proportion of Ontario employment in each of nine regions - 110 Industries, 1971 (continued)

S.I.C.	Name of Industry	Northwest Ontario	Northeast Ontario	Lake Huron/ Bruce	Central Ontario	Eastern Ontario	Toronto Region	Lake St. Clair	London/ Lake Erie	Kitchener/ Hamilton/ St. Catharines
355	Ready-Mix Concrete	.025	.053	.021	.057	.121	.489	.027	.074	.133
356	Glass and Glass Products	.000	.000	.058	.057	.029	.492	.156	.028	.180
357	Abrasives Manufacturers	.000	.000	.000	.000	.032	.055	.005	.104	.804
358	Lime Manufacturers	.000	.081	.000	.000	.000	.000	.000	.554	.365
359	Misc. Non-Metallic Mineral	.001	.008	.000	.100	.018	.445	.146	.022	.239
365	Petroleum Refineries	.000	.006	.003	.011	.010	.603	.313	.014	.041
369	Misc. Petroleum, Coat Products	.000	.000	.037	.000	.037	.630	.037	.000	.259
372	Mixed Fertilizers	.000	.000	.056	.056	.048	.092	.311	.207	.231
373	Plastics, Synthetic Resins	.000	.019	.000	.062	.230	.394	.085	.004	.206
374	Pharmaceuticals, Medicines	.002	.004	.002	.039	.079	.726	.063	.031	.056
375	Paint and Varnish	.000	.006	.007	.008	.027	.766	.039	.047	.099
376	Soap and Cleaning Compound	.000	.003	.001	.012	.010	.684	.004	.016	.271
377	Toilet Preparations	.000	.002	.004	.054	.102	.797	.006	.007	.028
378	Industrial Chemicals	.008	.019	.004	.017	.138	.182	.396	.012	.224
379	Misc. Chemical Industries	.001	.063	.001	.030	.057	.610	.032	.041	.164
391	Scientif., Profess. Equip.	.001	.007	.006	.070	.187	.632	.012	.038	.047
392	Jewellery and Silverware	.000	.007	.001	.016	.088	.776	.015	.024	.073
393	Sporting Goods and Toy	.001	.000	.019	.025	.017	.721	.025	.004	.188
397	Signs and Display Industry	.004	.023	.002	.013	.028	.794	.021	.036	.079
399	Misc. Manufacturing	.001	.002	.034	.036	.119	.596	.026	.031	.155
	Non-Manufacturing	.029	.071	.031	.050	.155	.401	.059	.058	.146
	Total All Industries	.026	.064	.030	.049	.135	.409	.063	.057	166

SOURCE: Special tabulation prepared from computer tapes by Data Dissemination, Census Field, Statistics Canada

Table 4.5
Proportion of employment in specific industries in each Ontario region compared to proportion of total employment in each region - 110 industries, 1971

S.I.C.	Name of Industry	Northwest Ontario	Northeast Ontario	Lake Huron/ Bruce	Central Ontario	Eastern Ontario	Toronto Region	Lake St. Clair	London/ Lake Erie	Kitchener/ Hamilton/ St. Catharines
101	Meat and Poultry Products	-.02(38)	-.06(58)	.01(21)	-.03(71)	-.12(91)	.09(48)	-.03(39)	-.00(39)	.16(22)
102	Fish Products	.04(7)	-.06(75)	-.03(91)	-.05(97)	-.12(89)	-.29(98)	.62(1)	-.06(102)	-.06(90)
103	Fruit and Vegetables	-.03(59)	-.06(69)	.04(9)	-.01(36)	-.10(60)	-.18(89)	.25(5)	-.03(69)	.11(31)
104	Dairy Products	.00(11)	-.01(11)	.03(17)	.01(31)	.06(9)	-.16(86)	-.01(26)	.04(21)	.04(54)
105	Flour & Breakfast Cereal	-.02(24)	-.06(53)	-.01(49)	.11(8)	-.11(80)	-.16(83)	-.04(55)	.24(3)	.05(52)
106	Feed	-.01(20)	-.06(56)	.13(3)	.06(13)	.01(16)	-.24(95)	-.00(24)	.07(13)	.05(51)
107	Bakery Products	-.01(16)	-.02(16)	-.00(35)	-.01(50)	-.05(37)	.08(51)	-.02(36)	.03(24)	.01(68)
108	Miscellaneous Food Products	-.01(18)	-.06(45)	-.02(72)	.03(21)	-.03(30)	.17(34)	-.05(57)	-.01(45)	-.02(79)
109	Beverage	-.01(15)	-.02(19)	-.01(38)	-.02(60)	-.05(34)	-.02(70)	.09(12)	.06(16)	-.02(76)
151	Leaf Tobacco Processors	-.03(64)	-.06(76)	-.03(92)	-.05(98	-.14(104)	-.41(109)	.45(2)	.17(6)	.10(34)
153	Tobacco Products	-.03(65)	-.06(77)	-.03(93)	-.03(81)	-.12(94)	.09(46)	-.02(27)	-.00(37)	.20(15)
162	Rubber Products	-.03(66)	-.06(60)	.01(19)	.02(24)	-.12(93)	-.02(69)	-.05(70)	.00(33)	.25(13)
165	Plastics Fabricating	-.03(56)	-.06(65)	-.01(42)	.06(11)	-.10(68)	.15(38)	.01(19)	-.03(70)	.01(66)
172	Leather Tanneries	-.03(67)	-.06(78)	-.02(69)	.18(5)	-.09(50)	.18) 32)	-.06(95)	-.05(101)	-.05(88)
174	Shoe Factories	-.03(68)	-.06(72)	.01(22)	-.01(40)	.01(15)	-.08(78)	-.05(67)	.02(26)	.18(19)
175	Leather Glove Factories	-.03(69)	-.06(79)	.00(27)	-.05(99)	-.02(19)	-.20(92)	-.06(96)	-.06(103)	.46(5)
179	Luggage, Handbags, Small Leather	-.03(70)	-.06(80)	.04(10)	-.02(65)	-.03(29)	.13(42)	-.05(75)	-.04(81)	.07(42)
181	Cotton Yarn, Cloth Mills	-.03(71)	-.06(81)	-.03(75)	-.04(94)	.07(7)	-.35(101)	-.06(97)	.00(32)	.49(4)
182	Wool Yarn, Cloth Mills	-.03(72)	-.06(82)	.14(2)	-.03(66)	.02(12)	-.28) 96)	-.06(98)	-.04(79)	.34(9)
183	Man-made Fibre Yarn, Cloth	-.03(73)	-.05(31)	-.03(84)	-.01(37)	.49(1)	-.36(105)	-.06(92)	-.01(42)	.05(47)
184	Cordage and Twine	-.03(74)	-.06(83)	-.00(30)	-.05(100)	-.10(62)	-.36(104)	-.05(66)	-.03(68)	.67(1)

Table 4.5
Proportion of employment in specific industries in each Ontario region compared to proportion of total employment in each region - 110 industries, 1971 (continued)

S.I.C.	Name of Industry	Northwest Ontario	Northeast Ontario	Lake Huron/ Bruce	Central Ontario	Eastern Ontario	Toronto Region	Lake St. Clair	London/ Lake Erie	Kitchener/ Hamilton/ St. Catharines
185	Felt and Fibre Mills	-.03(75)	-.06(84)	-.01(37)	-.05(101)	-.05(39)	.02(63)	-.06(99)	-.06(104)	.30(10)
186	Carpet, Mat, Rug Industry	-.03(76)	-.06(85)	-.03(94)	.22(3)	-.09(48)	-.11(80)	-.06(90)	-.05(90)	.20(18)
187	Canvas Prod. Cotton, Jute	.03(8)	-.05(26)	-.03(95)	-.01(46)	-.11(76)	.23(26)	-.02(31)	-.03(72)	-.01(74)
188	Auto Fabric Accessories	-.03(77)	-.06(86)	-.01(48)	.06(12)	-.14(105)	-.16(85)	.36(3)	-.05(92)	.03(58)
189	Miscellaneous Textile	-.02(42)	-.06(48)	.03(15)	-.02(55)	-.08(45)	.15(37)	-0.5(74)	-0.3(74)	.09(37)
231	Hosiery Mills	-.03(78)	-.06(87)	-.01(40)	-.05(102)	-.10(69)	.11(44)	-.06(100)	.25(2)	-.04(85)
239	Knitting (Excluding Hosiery)	-.03(79)	-.06(67)	.01(24)	-.03(82)	-.07(43)	-.02(71)	-.06(101)	.08(12)	.20(17)
243	Men's Clothing	-.02(23)	-.06(88)	-.01(50)	-.04(91)	-.06(40)	.12(43)	-0.6(86)	-.05(87)	.18(20)
244	Women's Clothing	-.02(46)	-.06(71)	-.03(89)	-.03(80)	-.09(54)	.43(5)	-.06(87)	.01(31)	-.13(107)
245	Children's Clothing	-.03(80)	-.06(89)	-.03(96)	-.05(103)	-.11(77)	.33(14)	-.03(38)	-.06(105)	.03(59)
246	Fur Goods	-.02(27)	-.06(17)	-.03(97)	-.02(64)	-.14(106)	.50(3)	-.06(102)	-.06(106)	-.11(101)
248	Foundation Garments	-.03(81)	-.06(47)	-.03(98)	-.05(104)	.27(2)	.15(36)	-.06(103)	-.05(93)	-.15(109)
249	Miscellaneous Clothing	-.02(31)	-.06(35)	-.02(61)	-.05(105)	-.04(33)	.18(33)	-.02(32)	-.05(97)	.08(39)
251	Sawmills, Planting, Shingles	.08(5)	.36(3)	.04(11)	.05(16)	.06(8)	-.38)107)	-.05(56)	-.04(80)	-.12(105)
252	Veneer and Plywood Mills	.11(4)	.42(1)	-.00) 34)	.01(28)	.03(11)	-.38(108)	-.06(104)	.00(36)	-.12(104)
254	Sash, Door, Other Millwork	-.01(21)	-.01(13)	.06(7)	-.02(61)	-.01) 18)	.06(55)	-.05(61)	.02(29)	-.03(80)
256	Wooden Box Factories	-.03(82)	-.06(44)	-.00(32)	-.02(63)	-.11(78)	-.17) 87)	.07(14)	.23(4)	.08(38)
258	Coffin and Casket Industry	-.03(83)	-.06(90)	.00(28)	.11(7)	-.11(81)	-.00(65)	-.05(64)	.12(10)	.02(60)
259	Miscellaneous Wood Industries	.12(3)	.05(7)	.08(5)	.05(17)	-.02(20)	-.19(91)	-.04(51)	-.01(40)	-.04(84)
261	Household Furniture Manuf.	-.03(49)	-.05(30)	.18(1)	-.00) 35)	-.09(53)	.06(57)	-.04(50)	-.02(54)	-.00(69)
264	Office Furniture Manuf.	-.03(84)	-.06(91)	-.02(57)	.01(32)	-.02(21)	.09(49)	-.06(91)	-.05(91)	.14(24)
266	Misc. Furniture, Fixtures	-.93(52)	-.05(29)	-.02(56)	-.03(70)	-.07(42)	.26(20)	-.03(44)	-.02(59)	-.01(75)

Table 4.5
Proportion of employment in specific industries in each Ontario region compared to proportion of total employment in each region - 110 Industries, 1971 (continued)

S.I.C.	Name of Industry	Northwest Ontario	Northeast Ontario	Lake Huron/ Bruce	Central Ontario	Eastern Ontario	Toronto Region	Lake St. Clair	London/ Lake Erie	Kitchener/ Hamilton/ St. Catharines
268	Electric Lamp and Shade	-.03(85)	-.06(92)	-.03(99)	-.05(106)	-.14(107)	.58(1)	-.06(105)	-.06(107)	-.15(110)
271	Pulp and Paper Mills	.35(1)	.18(4)	-.02(60)	-.04(90)	.01(14)	-.35(102)	-.06(94)	-.05(98)	-.02(77)
272	Asphalt Roofing	-.03(86)	-.06(93)	-.03(100)	-.05(107)	-.14(108)	.31(16)	-.04(54)	-.06(108)	.09(35)
273	Paper Box and Bag	-.03(61)	-.06(94)	-.01(47)	-.01(44)	-.10(66)	.23(24)	-.05(69)	.06(15)	-.03(81)
274	Misc. Paper Converters	-.02(37)	-.06(73)	-.02(62)	-.01(53)	-.12(90)	.38) 10)	-.05(77)	-.04(83)	-.04(86)
286	Commercial Printing	-.02(39)	-.05(32)	-.00(31)	-.02(62)	-.03(31)	.26(21)	-.04(52)	.00(35)	-.08(92)
287	Platemaking, Typesetting	-.03(87)	-.06(95)	-.02(70)	-.04(96)	-.11(73)	.42(6)	-.04(48)	-.02(56)	-.10(95)
288	Publishing Only	-.02(29)	-.06(51)	-.02(67)	-.03(84)	-.11(72)	.43(4)	-.05(65)	-.03(73)	-.10(98)
289	Publishing and Printing	-.00(14)	-.02(15)	-.00(33)	-.01(47)	-.02(27)	.10(45)	-.00(23)	-.00(38)	-.03(82)
291	Iron and Steel Mills	-.03(63)	.15(6)	-.03(88)	-.03(78)	-.14(101)	-.28(97)	-.06(79)	-.05(99)	.46(6)
292	Steel Pipe and Tube Mills	-.02(45)	.17(5)	-.03(101)	-.04(95)	-.14(103)	-.18(90)	-.05(78)	.17(5)	.13(26)
294	Iron Foundries	-.02(35)	-.03(21)	-.02(58)	-.03(85)	-.09(49)	-.15(82)	.23(9)	-.02(58)	.14(25)
295	Smelting, Refining (+Alum.)	-.03(88)	.40(2)	-.03(102)	-.03(74)	.02(13)	-.22(93)	-.05(76)	-.05(94)	-.01(72)
297	Copper Rolling, Casting etc.	-.03(89)	-.02(17)	-.03(76)	-.03(69)	-.13(95)	.23(25)	-.04(53)	.06(17)	-.02(78)
298	Metal Rolling, Casting etc.	-.03(90)	-.05(34)	-.03(79)	-.01(43)	-.02(23)	.06(56)	.02(17)	.00(34)	.05(50)
301	Boiler and Plate Works	-.03(91)	-.06(66)	-.01(44)	-.04(87)	-.11(74)	-.18(88)	-.05(58)	-.04(78)	.50(3)
302	Fab. Structural Metal Ind.	.01(10)	-.02(14)	-.02(64)	-.03(67)	-.09(52)	.14(39)	-.00(25)	-.03(66)	.03(55)
303	Ornam., Architech. Metal Ind.	-.02(43)	-.05(33)	-.02(53)	-.03(73)	-.10(59)	.24(23)	-.03(42)	.06(14)	-.06(89)
304	Metal Stamping, Coating etc.	-.02(32)	-.06(57)	-.02(59)	-.01(42)	-.10(71)	.13(41)	-.00(22)	-.02(53)	.11(30)
305	Wire and Wire Products	-.02(40)	-.06(74)	.01(20)	-.02(57)	-.07(44)	-.08(77)	-.02(30)	-.01(41)	.27(11)
306	Hardware, Tool, Cutlery	-.03(62)	-.06(49)	.01(25)	-.01(48)	-.10) 64)	.03(62)	.14(10)	-.03(60)	.05(48)
307	Heating Equipment Manufact.	-.02(44)	-.06(96)	-.02(52)	-.02(58)	-.09(55)	.26(22)	-.02(29)	-.04(77)	.02(64)

Table 4.5
Proportion of employment in specific industries in each Ontario region compared to proportion of total employment in each region - 110 industries, 1971 (continued)

S.I.C.	Name of Industry	Northwest Ontario	Northeast Ontario	Lake Huron/ Bruce	Central Ontario	Eastern Ontario	Toronto Region	Lake St. Clair	London/ Lake Erie	Kitchener/ Hamilton/ St. Catharines
308	Machine Shops	-.01(19)	-.02(18)	-.01(41)	-.00(34)	-.09(51)	.08(53)	-.00(21)	-.01(49)	.06(44)
309	Misc. Metal Fabricating	-.03(57)	-.06(50)	-.01(45)	.04(20)	-.10(65)	-.01(66)	.07(15)	-.02(52)	.11(29)
311	Agricultural Implements	-.02(41)	-.06(97)	-.02(55)	-.01(41)	-.14(102)	-.11(81)	-.05(59)	-.01(48)	.42(8)
315	Misc. Machinery, Equipment	-.02(34)	-.04(25)	.03(13)	.05(14)	-.10(63)	-.00(64)	-.03(41)	.04(22)	.08(40)
316	Commercial Refrigeration	-.03(92)	-.06(98)	-.03(78)	.05(18)	-.10(61)	-.07(75)	-.05(71)	.05(19)	.24(14)
318	Office and Store Machinery	-.02(30)	-.05(28)	-.03(83)	-.04(89)	-.08(46)	.38(11)	-.03(43)	-.03(71)	-.10(97)
321	Aircraft and Parts	.02(9)	-.06(99)	-.03(81)	-.01(52)	-.11(83)	.42(7)	-.06(89)	-.05(100)	-.11(99)
323	Motor Vehicle and Parts	-.03(60)	-.06(55)	-.00(36)	-0.3(68)	-.14(99)	-.03(72)	.24(8)	.01(30)	.03(56)
324	Truck Body and Trailer	-.01(17)	-.06(39)	.07(6)	-.01(38)	-.11(85)	-.09(79)	.03(16)	.12(9)	.05(49)
326	Railroad Rolling Stock	.05(6)	-.06(61)	-.03(103)	-.04(93)	-.14(109)	-.30(99)	-.05(60)	.14(8)	.42(7)
327	Shipbuilding and Repair	.12(2)	-.06(100)	.05(8)	.32(1)	-.13(97)	-.37(106)	-.05(73)	-.06(109)	.18(21)
328	Boat Building and Repair	-.01(22)	.03(8)	.03(12)	.09(10)	-.05(36)	-.16(84)	-.02(33)	-.03(62)	.11(28)
329	Misc. Vehicle Manufacturers	-.03(93)	-.06(101)	-.03(104)	.23(2)	-.11(87)	.07(54)	-.06(106)	-.02(51)	.01(67)
331	Small Elect. Appliances	-.02(36)	-.06(43)	-.02(65)	.14(6)	-.09(57)	.09(47)	-.06(81)	-.03(67)	.06(46)
332	Major Appliances	-.03(94)	-.06(62)	-.03(82)	-.03(77)	-.11(79)	-.04(73)	-.06(88)	.09(11)	.26(12)
333	Lighting Fixtures	-.03(95)	-.06(102)	-.03(105)	-.04(92)	-.14(100)	.50(2)	-.06(107)	-.03(63)	.12(102)
334	Household Radio-TV Receivers	-.03(96)	-.06(70)	-.02(68)	-.01(51)	-.02(25)	.14(40)	-.06(93)	-.05(89)	.12(27)
335	Communications Equipment	-.03(50)	-.06(54)	-.02(51)	.03(22)	.07(5)	.04(58)	-.06(85)	.02(27)	-.01(71)
336	Elect. Industrial Equipment	-.03(54)	-.06(68)	-.01(46)	.19(4)	-.11(88)	-.01(67)	-.05(72)	-.01(43)	.10(33)
338	Electric Wire and Cable	-.03(97)	-.06(103)	-.03(85)	.10(9)	.07(6)	.03(61)	-.06(108)	-.04(85)	.02(63)
339	Misc. Electrical Products	-.03(98)	-.06(104)	-.02(54)	-.03(72)	-.09(58)	.29(18)	-.05(63)	.04(23)	-.05(87)
351	Clay Products	-.02(25)	-.06(46)	.02(18)	.00(33)	-.02(26)	-.04(74)	-.02(28)	-.01(46)	.15(23)
352	Cement Manufacturers	-.02(28)	-.05(27)	.09(4)	-.02(56)	.17(3)	-.07(76)	-.06(84)	.05(18)	-.10(96)

Table 4.5
Proportion of employment in specific industries in each Ontario region compared to proportion of total employment in each region - 110 industries, 1971 (continued)

S.I.C.	Name of Industry	Northwest Ontario	Northeast Ontario	Lake Huron/ Bruce	Central Ontario	Eastern Ontario	Toronto Region	Lake St. Clair	London/ Lake Erie	Kitchener/ Hamilton/ St. Catharines
353	Stone Products	-.03(99)	-.06(105)	-.03(106)	.04(19)	-.05(35)	.17(35)	-.06(109)	-.01(47)	.03(57)
354	Concrete Products	-.00(11)	-.03(20)	.00(29)	-.01(49)	-.02(28)	.03(60)	-.02(35)	.03(25)	.02(62)
355	Ready-Mix Concrete	-.00(12)	-.01(12)	-.01(39)	.01(26)	-.02(22)	.08(52)	-.04(45)	.02(28)	-.03(83)
356	Glass & Glass Products	-.03(100)	-.06(106)	.03(14)	.01(27)	-.11(82)	.08(50)	.09(11)	-.03(65)	.01(65)
357	Abrasives Manufacturers	-.03(101)	-.06(107)	-.03(107)	-.05(108)	-.11(75)	-.35(103)	-.06(82)	.05(20)	.64(2)
358	Lime Manufacturers	-.03(102)	.02(9)	-.03(108)	-.05(109)	-.14(110)	-.41(110)	-.06(110)	.50(1)	.20(16)
359	Misc. Non-Metallic Mineral	-.03(51)	-.06(36)	-.03(109)	.05(15)	-.10(67)	.03(59)	.08(13)	-.01(76)	.07(41)
365	Petroleum Refineries	-.03(103)	-.06(41)	-.03(74)	-.04(86)	-.13(98)	.19(30)	.25(6)	-.04(84)	-.12(106)
369	Misc. Petroleum, Coal Prod.	-.03(104)	-.06(108)	.01(23)	-.05(110)	-.10(70)	.22(28)	-.02(37)	-.06(110)	.09(36)
372	Mixed Fertilizers	-.03(105)	-.06(109)	.03(16)	.01(29)	-.09(56)	-.32(100)	.25(7)	.15(7)	.07(44)
373	Plastics, Synthetic Resins	-.03(106)	-.04(24)	-.03(110)	.02(25)	.09(4)	-.02(68)	.02(18)	-.05(96)	.04(53)
374	Pharmaceuticals, Medicines	-.02(47)	-.06(52)	-.03(77)	-.01(39)	-.06(41)	.32(15)	.00(20)	-.03(64)	-.11(100)
375	Paint and Varnish	-.03(107)	-.06(42)	-.02(63)	-.04(88)	-.11(86)	.36(13)	-.02(34)	-.01(44)	-.07(91)
376	Soap and Cleaning Compound	-.03(108)	-.06(59)	-.03(87)	-.03(83)	-.13(96)	.27(19)	-.06(83)	-.04(82)	.11(32)
377	Toilet Preparations	-.03(109)	-.06(64)	-.02(73)	.01(30)	-.04(32)	.39(8)	-.06(80)	-.05(88)	-.14(108)
378	Industrial Chemicals	-.02(26)	-.04(23)	-.02(71)	-.03(75)	-.00(17)	-.23(94)	.33(4)	-.04(86)	.06(45)
379	Misc. Chemical Industries	-.03(58)	-.00(10)	-.03(90)	-.02(54)	-.08(47)	.20(29)	-.03(40)	-.02(50)	-.00(70)
391	Scientif., Profess. Equipment	-.02(48)	-.06(38)	-.02(66)	.02(23)	.05(10)	.22(27)	-.05(68)	-.02(55)	-.12(103)
392	Jewellery and Silverware	-.03(110)	-.06(40)	-.03(86)	-.03(76)	-.05(38)	.37(12)	-.05(62)	-.03(75)	-.09(94)
393	Sporting Goods and Toy	-.03(55)	-.06(110)	-.01(43)	-.02(59)	-.12(92)	.31(17)	-.04(47)	-.05(95)	.02(61)
397	Signs and Display Industry	-.02(33)	-.04(22)	-.03(80)	-.03(79)	-.11(84)	.38(9)	-.04(49)	-.02(57)	-.09(93)
399	Misc. Manufacturing	-.03(53)	-.06(63)	.01(26)	-.01(45)	-.02(24)	.19(31)	-.04(46)	-.03(61)	-.01(73)

SOURCE: See Table 2.4

create large cities and aid them in retaining their industrial base. The Toronto region, having achieved its present size, can offer a large market to firms seeking the advantages of large scale production. As such firms become located near each other, certain additional advantages emerge which keep them together and draw still more firms to the same area. All producers in the larger cities benefit from the existing infrastructure (roads, communications and research institutions) which can be provided without excessive taxation because their costs are spread over a larger number of taxable units. Producers located in cities also benefit from the agglomeration economics such as available suppliers of specialized labour, specialized suppliers, research institutions and market organizations. However, there are costs associated with large cities: dense populations bring higher crime rates, congestion and pollution; rents and wages rise as firms compete for space and labour. For some firms the benefits outweigh the costs, but for others a location outside the metropolitan area is preferred. It was a working hypothesis in Chapter Three that Toronto is a unique entity which has much to offer beyond the mere fact of population density. The statistical analysis succeeded in identifying those industries which benefit enough from Toronto to warrant location there despite the advantages.

The special role played by the Toronto region is brought out in Tables A4.2 and A4.3, which were described above. Relative to other regions, the Toronto region's employment is greatest in finance, insurance and real estate; transportation, communication and other utilities; total trade (retail plus wholesale) and transportation and storage and real estate in that order. In government subsidized activities it ranks low. The four classes which are relatively smallest are education and related services, health and welfare services, accommodation and food services and, last, public accommodation and defence. The manufacturing sector for the Toronto region is ranked sixth, yet the percentage employment in manufacturing is 3.1 greater than the percentage in all industries.

Looking toward those ranks in Table 4.5 with lowest numbers, there is an indication that at least part of the manufacturing specialization of Toronto may be explained as service to the financial-commercial sector. Among these, ranked 4th, 6th, 10th and 11th, are Publishing Only (288), Platemaking, Typsetting and Trade Bindery Industry (287), Miscellaneous Paper Converters (274) and Office and Store Machinery (318). Commercial Printing (286) ranks only 21st but percentage employment is still 26 points

greater than the percentage of total Ontario manufacturing employment in the Toronto region. The statistical analysis of county level data established that locations of these industries are best explained by the Toronto county dummy variable, and it must be concluded that they fit firmly in the economic structure of the region of Toronto.

The output of a second group of industries consists of market-oriented end-products. Thus in the production of textiles and clothing it will be noted that (1) the clothing sector (which is at the end stage of processing) is a Toronto specilaization but the textile portion (which is at the earlier stage of processing) is not, and (2) within the clothing sector it is the market-oriented lines of production that dominate.

The clothing portion of the textile industry, and particularly the market-oriented portion of it, are among the top lines of specialization. Ranked 3rd, 5th and 14th in importance out of 110 industries are Fur Goods Industry (246), Women's Clothing Industries (244) and the Children's Clothing Industry (235). Men's Clothing Industries (243) which, according to the statistical analysis of Chapter Three, is less market-oriented and partly explained by Knitting Mills (239), is ranked 43rd. In the input-output table for Canada 1971 and in the county level statistical analysis of Chapter Three, the Knitting Mills (239) classification is shown to be an important supplier to the clothing industries, yet it ranks 71st among the 110 manufacturing industries displayed in Table 4.5. All of the industries at the earlier stage of processing (S.I.C. 181-239) are ranked 37th or lower except the Canvas Products and Cotton and Jute Bags Industries (187), ranked 26th.

The stage of processing dichotomy is also observable in the industries producing wood products. The percentage employment in the early stage of processing in S.I.C. 251 through 259, in Table 4.5, falls below the regional share except in Sash, Door and Other Millwork (254), while at the later stages classifications 261 through 268 are above the regional share. The end-product producers employing more than the regional share include Household Furniture Manufacturers (264), Miscellaneous Furniture and Fixtures Manufacturers (266) and Electric Lamp and Shade Manufacturers (268). Such classes as Sawmills, Planning Mills and Shingle Mills (251), Veneer and Plywood Mills (252), Wooden Box Factories (256) and Miscellaneous Wood Industries (259) locate more outside the Toronto region.

The top twenty specializations of the Toronto region are end-product

producers. Many of these have been mentioned in the discussion above, but in addition the reader will find supporting evidence from examination of the ranks of S.I.C.'s at the end of the list in Table 4.5. No less than seven of the last eleven end-product categories 374-399 are in the top twenty Toronto specializations. Manufacturers of Pharmaceuticals and Medicines (374) is ranked 15th and Toilet Preparations (377) is eighth, etc.

Heavy industries relating to iron and steel are missing from the Toronto region. Employment in Iron and Steel Mills (291), Steel Pipe and Tube Mills (292) and Iron Foundries (294) is less than the regional share. The first stage of non-ferrous metal processing, Smelting and Refining, (295) is also well below the regional share. The county level statistical analysis of Chapter Three shows that the percentage employment in Iron and Steel Mills (291) is an important locational variable in many metal fabricating industries, but Smelting and Refining (295) does not play a similar role. Despite the relative absence of this early stage of processing there is a fairly long list of metal-based industries which are among the Toronto region's specializations, including Aircraft and Aircraft Parts Manufacturers (321), Commercial Refrigeration and Air Conditioning Equipment Manufacturers (316), Heating Equipment Manufacturers (307), the Fabricated Structural Metal Industry (302), the Ornamental and Architectural Metal Industry (303) Metal Stamping, Pressing and Coating Industry (304) and Machine Shops (308). The fact that many of these are seen to be locationally related to Iron and Steel Mills (291) makes them appear misplaced, but typically they are products with a market orientation. They are discussed in further detail below in connection with the description of other regions.

One general class of industry conspicuous by its absence relates to transportation equipment. With the exception of Aircraft and Aircraft Parts Manufacturers (321), all other production relating to automobiles, trains, buses, ships and boats rank 54th or greater in the ordering.

Because of the relative importance of the service industries in the region, Toronto is a net importer of most commodities. The trade figures (see Table 4.2) are consistent with this hypothesis. In general, however, one must approach these figures with great caution, particularly with regard to commodities which are not produced at all in Toronto. Tables A4.2 and A4.3 demonstrate the relative and asbolute importance of retail and wholesale trade, and of transportation and storage, in the Toronto

region. If there is no local production, any inventory accumulation will produce an apparent net import, and any decumulation will result in an apparent net export. Several categories of resources appear as small net exporters from Toronto in 1975, e.g. Nickel and Copper Concentrates (CFTM 28) and Pulpwood Logs and Chips (CFTM 22). Trade figures are also affected by the inferior quality of trucking statistics which are based on sampling. Trips between destinations on or near the border of two regions are likely to be underestimated. Thus shipments of new automobiles by truck from Oakville to Toronto may be poorly estimated, but rail shipments out would be based on 100 per cent sampling and therefore are well estimated. Pipelines cause a further problem with the Toronto region because these are excluded from the trade data. For instance, Toronto is shown as a net exporter of crude petroleum and natural gas (CFTM 34).

Summary and conclusions relating to the Toronto region

The service sector of the Toronto region ranks above manufacturing, but manufacturing itself must be considered a specialization of the region. The manufacturing sector is specialized in such a manner as to provide the commodities needed by the service sector, or to supply end-products to the dense population. The prominence of the service sector is not due to the presence of the provincial government in the city of Toronto. Government activities rank relatively low as a source of employment.

The unique feature of the Toronto region is the dense population of Toronto county, which is both a cause and an effect of its specialization in finance, insurance, communications, transportation, and storage. These activities are a forward linkage for firms in the paper and publishing classification of the S.I.C. End stages of processing are specializations of the Toronto region while earlier stages are not. Manufacturing in the Toronto region therefore can be understood as providing necessary commodity inputs to the service industry, and providing consumer goods to the large population, and is encouraged due to the availability of transportation, communications and specialized marketing services. The end stages of processing are pursued in the Toronto region, while earlier stages are found outside. For example, the men's, women's and children's clothing industries in the Toronto region represent the end stages of

processing and employ relatively more than the textiles industry, which is representative of the earlier stage of processing. This is also true in the paper/wood related industries. Heavy industries relating to iron and steel and the transportation industries are presented to a far less extent than end-products generally. As an exporter of services the Toronto region must be a net importer (not exporter) or most manufactured goods. The image of a Toronto region greedily acquiring all of Ontario's manufacturing industry is incorrect.

The results of the statistical analysis of Chapter Three showed that the locations of 39 out of 110 industries could be explained by city size and county density variables. In many of these the unique features of Toronto prove statistically significant. From this and from the actual features of the Toronto region discussed in this chapter it is concluded that these industries are an integral part of the Toronto structure, and not likely to respond to policies aimed at dispersing them. There would seem no compelling reason, however, for the continued expansion of the manufacturing base in Toronto at the earlier stages of processing. The statistical analysis of Chapter Three indicated that the Smelting and Refining (295) industries had failed to establish forward linkage industries, and that it was itself to some extent drawn to Toronto through backward linkages. Similarly it was found in Chapter Three that, although Iron and Steel Mills (291) are an important backward linkage for many industries, in several cases this linkage is broken and we find the heavy iron and steel based industry in the Toronto region. We may cite the Fabricated Structural Metal Industry (302), Ornamental and Architectural Metal Industry (303) and Heating Equipment Manufacturers (307) as examples of this. Transportation costs of industries related technologically to Iron and Steel Mills (291) or Smelting and Refining (295) are recommended as objects of future research that would produce a comparison of costs in different locations.

Kitchener, Hamilton and St. Catharines

The percentage of Ontario manufacturing in the Kitchener/Hamilton/St. Catharines region is 40 per cent of that in the Toronto region but ranks higher in relative terms. The percentage of manufacturing employment in the Toronto region is 3.1 points greater than its percentage in all employment, whereas in Kitchener/Hamilton/St. Catharines the percentage employ-

ment in finance, insurance and real estate is 16.3 points higher than its percentage in all types of employment. In Kitchener/Hamilton/St. Catharines the percentage in finance, insurance and real estate is 4 points less than all categories of employment. In addition to being more specialized in manufacturing, Kitchener/Hamilton/St. Catharines has an industrial structure at least as broadly based as the Toronto region. There are 66 S.I.C. classes in the Toronto region for which the percentage employed exceeds the region's share of manufacturing employment in all categories, but in Kitchener/Hamilton/St. Catharines there are 70 such classes.

The most significant fact about the Kitchener/Hamilton/St. Catharines region is its specialization in Iron and Steel Mills (291). The sales of Iron and Steel Mills (291) shown in Table 4.6 below is an indication of its potential as a locational factor for other industries, but this classification is not unique in this respect. Table 4.6 shows sales from the Smelting and Refining (295) industry which are also extensive. The statistical results of Chapter Three, however, show that percentage employment in Iron and Steel Mills (295) are an important locational factor, the corresponding industry is higher ranked in the Kitchener/Hamilton/St. Catharines region than in the Toronto region (see S.I.C. 304, 305, 306, 309 and 311). There are three exceptions to this amongst the metal fabricating industries; more highly ranked in the Toronto region are the Fabricated Structural Metal Industry (302), the Ornamental and Architectural Metal Industry (303), and Heating Equipment Manufacturers (307). The specialization of the Kitchener/Hamilton/St. Catharines region is reflected in the regional trade figures of Table 4.3 where we find a relatively large volume of exports of iron and steel basic products. (The CFTM class 71 consists of S.I.C. 291, 292, 301, 302, 304 and 305). We also find net exports of metal fabricated goods (CFTM 75), of machinery (CFTM 81), and of agricultural machinery (CFTM 82).

The concentration of Iron and Steel Mills (291) in the Niagara Peninsula is due in part of the port facilities of the area and the availability of water transport. Iron, coal and transportation rank first, second and fourth as costs, and the latter rises rapidly if overland transportation is needed. Similarly, costs rise rapidly with transportation of the output, and this constitutes the rationale for the location of later stages of processing near Iron and Steel mills (291), and explains the

TABLE 4.6
Percentage distribution of total output of the Iron and Steel Industry as intermediate goods

S.I.C.	INPUT-OUTPUT NAME	PERCENT
304	Metal Stamp., Press. & Coat Ind.	0.128
323, 325	Motor Veh. Parts & Access. Mfgrs.	0.106
291	Iron & Steel Industry	0.089
292	Steel Pipe & Tube Mills	0.074
315	Misc. Machinery & Equipment Mfgrs.	0.055
305	Wire & Wire Products Mfgrs.	0.055
302	Fabricated Struct. Metal Ind.	0.053
309	Misc. Metal Fabricating Ind.	0.046
404-421	Other Engineering Construction	0.038
404-421	Non-Residential Construction	0.026
303	Ornamental & Archit. Metal Ind.	0.021
332	Major Applicances Elect. & Non-Elect	0.018
336	Mfgrs. of Elect. Indust. Equipment	0.018
308	Machine Shops	0.017
295	Aluminum Smelting & Refining	0.017
404-421	Railway, Telephone, Telegraph Constr.	0.017
301	Boiler & Plate Works	0.017
311	Agricultural Implement Ind.	0.016
327	Shipbuilding & Repair	0.015
326	Railroad Rolling Stock Ind.	0.013
306	Hardware, Tool & Cutlery Mfgrs.	0.012
404-421	Repair Construction	0.012
294	Iron Foundries	0.010
333, 339	Mfgrs. of Misc. Elect. Products	0.010

SOURCE: See Table 2.6

mutually reinforcing growth of the two. The Niagara peninsula has no doubt benefitted greatly from the efficiency of the Canadian steel industry.

In the discussion of the Toronto region, evidence was presented that pointed to Toronto as locationally preferred by end-products producers and firms which would be willing and able to pay the higher rents in Toronto in order to benefit from the transportation, communication, and specialized marketing facilities. This is most apparent in the textile and clothing sector. The Hamilton specialization is in the basic intermediate products. From Table 2.5 it is seen that Cotton Yarn and Cloth Mills (181) Wool Yarn and Cloth Mills (182), Felt and Fibre Mills (185) and Knitting Mills (239) are specializations higher ranked in Kitchener/ Hamilton/ St. Catharines, but the market-oriented clothing industries are

TABLE 4.7
Percentage distribution of total output of Smelting and Refining sold as intermediate goods

S.I.C.	INPUT-OUTPUT NAME	PERCENT
297	Copper & Alloy Rolling	0.335
291	Iron & Steel Industry	0.111
298	Metal Casting & Extruding n.e.s.	0.061
392	Jewellery & Silverware Mfgrs.	0.048
304	Metal Stamp., Press. & Coat. Ind.	0.036
295	Other Smelting & Refining	0.033
305	Wire & Wire Products Mfgrs.	0.032
378	Mfgrs. of Industrial Chemicals	0.029
309	Misc. Metal Fabricating Ind.	0.028
338	Mfgrs. of Electric Wire & Cable	0.026
323, 325	Motor Veh. Parts & Access. Mfgrs.	0.021
336	Mfgrs. of Elect. Indust. Equipt.	0.018
333-339	Mfgrs. of Misc. Elect. Products	0.016
-	Operating Supplies	0.015
321	Aircraft & Parts Mfgrs.	0.015
271	Pulp & Paper Industry	0.013
294	Iron Foundries	0.013
365	Petroleum Refineries	0.013
335	Communications Equipment Mfgrs.	0.012
391	Scient. & Prof. Equipt. Mfgrs.	0.010
315	Misc. Machinery & Equipt. Mfgrs.	0.010
3391	Battery Mfgrs.	0.010

SOURCE: Data supplied by Customer Services, Structural Analysis Division, Statistics Canada

more highly ranked in the Toronto region. Examination of the input-output table suggested that Knitting Mills (183) would be an important locational factor for other industries. This failed to be confirmed by the statistical analysis in any of the three market-oriented categories (S.I.C. 244, 245, and 246), but was true for Men's Clothing Industries (243).

The statistical analysis of Chapter Three demonstrates that most of the clothing and textile industries are market-oriented, that is, located near an industrial buyer or in the larger cities. The population density and market (not resources) account for the presence of textiles and clothing in Ontario, and the level of processing accounts for the distribution between the Toronto and the Kitchener/Hamilton/St. Catharines regions. In only two industrial classifications did this generality fail to produce a statistically significant explanation: the Cordage and Twine Industry (184) and Man-made Fibre, Yarn and Cloth Mills (183). Unfor-

tunately, the CFTM code does not provide a special commodity classification for either textiles or clothing, and hence production and trade figures cannot be compared.

The wood industries show the same division of specialization as was found in the case of clothing and textiles. Neither region specilizes in the earliest stage of processing (S.I.C. 251, 252). Wooden Box Factories (256) and the Coffin and Casket Industry (258) are a speciality of Kitchener/Hamilton/St. Catharines but not of the Toronto region. The Toronto region, but not the Kitchener/Hamilton/St. Catharines region, is specialized in Sash, Door and Other Millwork Plants (254), Household Furniture Manufacturers (261), Miscellaneous Furniture and Fixtures Manufacturers (266) and Electric Lamp and Shade Manufacturers (268). Both regions specialize in Office Furniture Manufacturers (264). In neither case, however, have the wood-related industries generated enough local production to produce a net export.

The statistical analysis and input-output data suggest that Forestry employment is a significant variable accounting for the three industries which are specializations of the north (251, 252 and 259). Input-output cost data suggest that these three might be statistically significant variables explaining location at later stages of processing, but this was not true. Market-oriented variables produced statistically significant results. The two industries where the statistical results are least satisfactory are higher ranked specializations of the Kitchener/Hamilton/St. Catharines region: Wooden Box Factories (256) and Office Furniture Manufacturers (264).

Because of the greater acreage of the surrounding area, agriculture has had a larger impact on the Kitchener/Hamilton/St. Catharines region than on Toronto. It is the only local resource of significance ranking above forestry and mining. Toronto has only three specializations based on agriculture: the Meat and Poultry Products Industries (101), Bakery Products (107), and Miscellaneous Food Products (108). Kitchener/Hamilton/St. Catharines specializes in all agriculture lines except Fish Products (102) and Miscellaneous Food Products.

The specialization in the Fruit and Vegetable Processing Industries (103) is due to the abundance of suitable land and the growing conditions in the Kitchener/Hamilton/St. Catharines region. Small fruit acreage is the most abundant and fruit trees acreage second most abundant of the

nine resource commodities compared in Table 4.2. Abundance of improved land also accounts for specialization in Dairy Products (104), the Feed Industry (106) and the Flour and Breakfast Cereal Products Industry (105). Input-output data suggest that each of these would be influenced by the percentage of improved land, and the statistical analysis of Chapter Three corroborates this. Specialization in the Bakery Products Industries (107) is related to the specialization in the Flour and Breakfast Cereal Products Industry (105). These two were statistically reinforcing, the presence of one increasing the likelihood of the other. The statistical analysis of Chapter Three indicates that the Bakery Products Industry (107) classification is significantly influenced by city size and by the percentage employment in the Flour and Breakfast Cereal Products Industry (105). County density has little influence per se. Table 4.5 shows that the Bakery Products Industries (107) category is a specialization of both the Kitchener/Hamilton/St. Catharines and the Toronto regions. In the Kitchener/Hamilton/St. Catharines region it is more likely that the presence of the Flour and Breakfast Cereal Products Industry (105) has greater influence, while in the Toronto region the influence of Toronto city accounts for the specialization in the Bakery Products Industries (107).

Tobacco Products (153) is another specialization of the Toronto and Kitchener/Hamilton/St. Catharines area which is related to the agricultural hinterland. The earlier stage of processing is Leaf Tobacco Products (151). Percentage of improved land acreage did not prove to be a statistically significant variable determining location of Leaf Tobacco Products (151). This was partly because the special conditions of climate and soil necessary for such a crop do not necessarily correspond to the distribution of improved land in general agricultural use. Furthermore, the location of production in Canada is influenced by the system of government production allocations. In 1971 ten per cent of tobacco acreage was located in Brant County and 47 per cent in Norfolk. Therefore at least 57 per cent of such acreage is found in the Kitchener/Hamilton/St. Catharines region, and this probably explains the specialization in Leaf Tobacco Products (151). Both the Toronto region and the Kitchener/Hamilton/St. Catharines region specialize in the next stage of processing, called simply Tobacco Products (153). In Kitchener/Hamilton/St. Catharines this might seem to be the result of specialization in Leaf Tobacco Products (151), but the statistical analysis of Chapter Three indicates that there is no significant relationship between percentage employment in Leaf Tobacco

Products (151) in a county, and percentage employment in Tobacco Products (153). The analysis indicates that the special features of Toronto city are the predominant influences, with some production attracted to city sizes 57,000 to 81,000. Unfortunately the CFTM commodity classification aggregates raw tobacco with processed tobacco and cigarettes (in class 17). The value of exports of the finished products from the centre of processing will exceed the value of imports of raw tobacco, yet because of the weight loss in processing there may be, and in fact is, a net import measured in tons for both Toronto and the Kitchener/Hamilton/St. Catharines region.

Both the Toronto region and Kitchener/Hamilton/St. Catharines have by virtue of their size drawn in more agricultural processing than is warranted by their immediate hinterland, but the Kitchener/Hamilton/St. Catharines region has developed a greater specialization based on agriculture. Wheat (CFTM 6) and live aminals (CFTM 1) are imported. Except for fresh and frozen meat imported into the Toronto region, later stages of processing are exported. Fresh and frozen meat (CFTM 2) is exported from Kitchener/Hamilton/St. Catharines and wheat flour (CFTM 8) is exported from both. Both also export at later stages (see CFTM 14, 15, 16 which include other food, feed and beverages).

The analysis of Chapter Three also fails to explain Meat and Poultry Products (101) in the Kitchener/Hamilton/St. Catharines region in terms of the related agricultural base. Well over 50 per cent of cost in this classification is used to purchase products of land, mostly live animals. The statistical analysis indicates, however, that Toronto city, city sizes 87,000 to 112,000 and county density are significant locational factors. As with Leaf Tobacco Products (151), more research is required to explain the specialization in meat products in Kitchener/Hamilton/St. Catharines. The effect on trade is clear from Table 4.3. The region exports fresh and frozen meat (CFTM 2 and 3).

The specialization in transportation in the Kitchener/Hamilton/St. Catharines region is in contrast with the Toronto region. In all related S.I.C. classifications (321-329) except Aircraft and Aircraft Parts Manufacturers (321) and Miscellaneous Vehicles Manufacturers (329), production is more specialized in Kitchener/Hamilton/St. Catharines. The input-output based statistical analysis of Chapter Three is not helpful in explaining this difference in terms of the rest of the province's industrial structure. Motor Vehicles and Parts Manufacturers (323, 325) and Truck

Body and Trailer Manufacturers (324) are specializations of all three regions which border on Lake Erie, (Lake St. Clair, London/Lake Erie, and Kitchener/Hamilton/St. Catharines), and the transportation corridor linking Buffalo to Detroit has no doubt had an influence. The influence of related industries was considered but no significant relationships were discovered. Because the industry is export-oriented, it is less dependent on the market offered by Toronto. That the trade of Kitchener/Hamilton/St. Catharines is consistent with its specialization in production is confirmed by Table 4.3. Automobile parts are exported via CFTM 85, buses and trucks through CFTM 84, and other vehicles through CFTM 86.

Summary and conclusions relating to the Kitchener, Hamilton and St. Catharines region

By contrast with Toronto the Kitchener/Hamilton/St. Catharines region is more dependent on commodity exports because the employment produced by services is far less. In this respect the region's dependence on the transportation industry leaves her vulnerable. The analysis of county level data did not establish any statistically significant locational linkages of industries in the transportation sector to industries in other sectors. The presence in the region of the transportation industry cannot be explained by such variables and, because of the export orientation of production, the decision concerning location will not be critically affected by demand in Ontario.

There are three factors which create stability in the Kitchener/Hamilton/St. Catharines region. Of these, the specialization in Iron and Steel Mills (291) is the strongest point, because the analysis of county level data has shown it to be important statistically in accounting for the location of other industries. Indeed, the statistical analysis of Chapter Three would suggest that the region has not fully realized the potential. Secondly, the region benefits as part of its position in the "golden horseshoe". Its role in this respect is to provide basic products and intermediate goods which are incorporated in finished goods elsewhere. Thirdly, the area has an agricultural base of some significance, and processes such output for local demand and export.

Lake St. Clair

Lake St. Clair represents the most westerly of the three regions bordering the north shore of Lake Erie, and shares with the other two a specialization in Motor Vehicles and Parts Manufacturers (323, 325) and Truck Body and Trailer Manufacturers (324). As noted above, the input-output and county level data discussed in Chapter Three did not succeed in explaining the location of this production in terms of technological linkages to Ontario's manufacturing. Although there is no characteristic of the region per se which accounts for the presence of the transportation industry, the industry has had a substantial impact on the region's manufacturing.

The Automobile Fabric Accessories Industry (188) is the third ranking specialization of the Lake St. Clair region and is its only specialization in textiles or clothing. Input-output data verify that the sales of this classification to the automobile industry is substantial. Statistical analysis of county level data establishes further that the automobile industry has a significant influence in the location of production. This is also true of two other classifications, Iron Foundries (294), ranked as 9th of the region's specializations, and Glass and Glass Products Manufacturers (356), ranked 11th.

There are four specializations relating to agriculture. Fish Products (102) ranks first in terms of the share of Ontario production in the Lake St. Clair region. This is obviously related to the region's strategic position between Lake Huron and Lake Erie, with Lake St. Clair adjoining. The 5th ranked specialization is the Fruit and Vegetable Processing Industry (103). Eleven per cent of Canadian acreage committed to vegetables is found in this region. Of the resources compared to Canada in the top of Table 4.2, vegetable acreage ranks first in Lake St. Clair. The region also shares with the neighbouring London/Lake Erie region a specialization in the Beverage Industries (109). The statistical results of Chapter Three demonstrate that the percentage of improved land acres combined with Miscellaneous Services is a significant variable determining the location of such production. These specializations account for the export trade of Lake St. Clair. From Table 2.3 it is verified that vegetables (CFTM 12) and beverages (CFTM 16) are exported.

The Lake St. Clair specialization in tobacco involves some peculiarities.

The number of acres committed to tobacco is 3rd highest of the nine Ontario regions but it amounts to no more than 4 per cent of the total, and would not seem sufficient to generate a regional specialization. Nevertheless, we find that percentage employment in Leaf Tobacco Processors (151) is the second ranked specialization and employs 45 per cent more than the region's share of all manufacturing. It must be assumed that this processing is based in part on the tobacco acreage of Elgin and Middlesex counties in the adjacent London/Lake Erie region. Despite its specialization in the Leaf Tobacco Processors (151) classification there is no corresponding specialization in the Tobacco Products Manufacturers (153) category, which is the next stage of processing. Implicitly, the export of tobacco (CFTM 17) is, therefore, confined to this earlier stage. The reason for this specialization at the earlier stage but not at the later stage is suggested by the statistical analysis of county data. This reveals that the location of Tobacco Products Manufacturers (153) is significantly determined by the unique features of Toronto county with some signficiant attractions to city sizes 57,000 to 81,000. It also implies that the percentage employment in Leaf Tobacco Processors (151) has no significant impact.

Kent and Lambton counties in Lake St. Clair, and Elgin and Oxford in the nearby London/Lake Erie region, are the only counties in Ontario where oil wells can be found to produce significant amounts, but pipelines are much more significant suppliers of oil stocks. Petroleum Refineries (365) are ranked 6th among the specilizations of the Lake St. Clair region and are an important input to four other classifications. Output of Petroleum Refineries (365) constitutes the largest cost item to the Manufacturers of Industrial Chemicals (378) classification. This classification ranks 4th highest in the percentage of Ontario employment located in the Lake St. Clair region. The county level data indicates that Industrial Chemicals (378) has a significant effect on the location of Manufacturers of Mixed Fertilizers (372) and on Manufacturers of Plastics and Synthetic Resins (373), which rank 7th and 18th respectively as specializations of the Lake St. Clair region. The Petroleum Refineries (365) classification is not the only independent variable of significance, however. Statistical results in Chapter Three based on county level data indicate that the percentage of employment in Mixed Fertilizers (372) also depends on the percentage of agricultural land in the county. The agricultural base of Lake St. Clair,

therefore, is an additional factor explaining specialization in Mixed Fertilizers (372).

The location of Plastics and Synthetic Resins (373) is more complex. Location near both the Manufacturers of Industrial Chemicals (378) which is the supplying industry, and the Plastics Fabricating Industry (165) which is the purchasing industry, is significant. But according to the statistical results of county level data in Chapter Three, this latter relationship is reciprocal. The Manufacturers of Plastics and Synthetic Resins (373) industry is a locational factor, as a buyer, for the Plastics Fabricating Industry (165). The Plastics Fabricating Industry (165) is the 19th ranked specialization of the Lake St. Clair region. These characteristics of production explain the region's export of chemicals (CFTM 61), fertilizers (CFTM 62) and chemical products (CFTM 63) reported in Table 4.3.

There are three other specializations of the Lake St. Clair region which require discussion. Two of these, Hardware, Tool and Cutlery Manufacturers (306) and Miscellaneous Metal Fabricating Industries (309), are locationally influenced by the presence of Iron and Steel Mills (291). All three counties in the Lake St. Clair region border at some point on the United States and are influenced by the industrial character of Detroit. Transportation costs limit the range that can be influenced by the iron and steel industry in the Kitchener/Hamilton/St. Catharines region, and therefore imports from the United States would be a locational factor in the Lake St. Clair region. Furthermore, Detroit serves as a market for Essex county: it is much closer to Windsor than is Toronto to Hamilton.

Of the four specializations in the Lake St. Clair, one - Iron Foundries - can be explained by the presence of the automobile and truck industry, and two others by the presence of Iron and Steel Mills (291), but in these latter two, market size plays an important role and therefore the Detroit market would be important. Hardware, Tool and Cutlery Manufacturers (306) is influenced by special characteristics of the largest city in the county (sizes I and III), and employment rises with county density. In Miscellaneous Metal Fabricating Industries (309), employment in Construction is an additional explanatory variable. Employment in Metal Rolling, Casting and Extruding (298) is explained by the size of the largest city in the county. Location is favourable in city sizes I, II and III (over 87,000).

More knowledge about the influence of the Detroit market on the industry of Windsor would be of value to the future planning of the Lake St. Clair region.

Summary and conclusions relating to the Lake St. Clair region

The location of Motor Vehicles and Parts Manufacturers (323, 325) and the Truck Body and Trailer Manufacturers (324) in the Lake St. Clair region has no statisticaly significant locational relationship to other variables which define Ontario's economic structure. As an exogenous influence, it is an important factor accounting for the location of technologically related industries in the region. The influence of Detroit explains the region's specialization in automobiles and trucks, and in some of the iron and steel related industries. Petroleum Refineries (365) and the technically related Industrial Chemicals (378) industries are a second source accounting for locations of several related industries. The agricultural surroundings constitute a third influence on industrial location. In this regard it was noted that there was a specialization in Leaf Tobacco Processors (151), but that the region has failed to take full advantage of its opportunities; we find no specialization in Tobacco Products Manufacturers (153), which is the next stage of processing. Policy matters relating to the tariff and the transportation industry will have greatest influence on the region's future development.

Northwestern and Northeastern Ontario

The resource basis for production in the Northwestern and Northeastern regions was documented in the opening section of this chapter. The impact of Forestry in establishing technologically related industries can be judged in terms of the regional specializations listed in Table 4.5. The Logging (031) industry represents the first stage of processed forestry products, and its presence in the north is a reflection of its abundance in Forestry. Although the Northwest is smaller in population than the Northeast, its value added in Logging (031) was greater. In 1971 the total value added in Logging (031) in the Northwest was 47 million dollars of 44.2 per cent of the Ontario total. Value added in the Northeast was 45 million dollars.

Output of Logging (031) is principally shipped to Sawmills (252), Pulp and Paper Mills (271), Veneer and Plywood Industries (252) and Miscellaneous Wood Industries (259). Examination of the rankings in Table 4.5 confirms that these industries are well established in the Northeast and Northwest. For Sawmills, Planing and Shingles (251), employment in the occupation is 8 per cent greater than the Northwest's share of all manufacturing employment and, as indicated in parentheses in Table 4.5, it ranks 5th as a specialization. The S.I.C. numbers, rank and percentage difference in the four forestry-based industries are (251, 5, 0.8), (252, 4, 0.11), (259, 3, 0.12), and (271, 1, 0.35) for Northwestern Ontario, and (251), 3, 0.36), (252, 1, 0.42), (259, 7, 0.05) and (271, 4, 0.18) in Northeastern Ontario. Despite their small populations, these two regions together have respecitvely 52.2, 61.6, 25.7 and 62.3 per cent of the employment in Ontario in the four industries (see Table 4.4). The statistical analysis of county level data in Chapter Three verifies that the location of all four is influenced by the percentage of Forestry employment and it is likely that these industries will continue to be a stable part of the economic base of Northern Ontario.

Trade figures displayed in Table 2.3 show that the Northwest exports logs, poles and other forest products (CFTM 23) which are also exported from the Northeast. Of the two regions, however, it is only the Northeast that exports pulpwood logs and chips (CFTM 22). This export performance carries through to later stages. Both regions are net exporters of lumber (including flooring), wood pulp, newsprint, and other paper (CFTM 52, 55-57). However, only the Northwest exports plywood and veneer (CFTM 53) and neither region has succeeded in extending this advantage far enough to become a net exporter of fabricated wood products (CFTM 54). This last classification includes not only railway ties, shingles, lath and poles, but also millwork and wood fabricated materials for structures.

Metal ores are also abundant in the north. Both the Northeast and the Northwest export iron ore, lead and zinc ores, and concentrates. Northwestern Ontario is the main exporter of copper ore and nickel-copper concentrates. One can trace the use of these ores through the input-output table. Eighty-one per cent of the output of Iron Mines (058) is taken by the S.I.C. equivalent Iron and Steel Mills (291), with smaller amounts shipped to other types of smelting. Ninety-six per cent of the output of the base metal mines is shipped to firms classified in the S.I.C.

equivalent industry Smelting and Refining (295). Neither of these is ranked near the top in the list for Northwestern Ontario displayed in Table 4.5. But in the Northeast we find 21.5 per cent of employment in Iron and Steel Mills (291) and 46.5 per cent of the employment in Smelting and Refining (295). Tables 4.6 and 4.7 above illustrated the potential of these two in the establishment of other industries in terms of the percentage of their sales required as intermediate goods in other production. The results of the analysis in Chapter Three indicate that Iron and Steel Mills (291) are much more of a locational factor than is Smelting and Refining (295). Iron and Steel Mills (291) are concentrated in the Kitchener/ Hamilton/St. Catharines region, where we find 62.9 per cent of the employment (see Table 4.4), but the presence of these in the Northeast is a factor on which further growth may be developed.

There are seven industries which are established statistically as locationally attracted to Iron and Steel Mills (291). According to Table 4.5, in only two of these, Smelting and Refining (295) and Steel Pipe and Tube Mills (292), is the percentage of employment greater than the Northeastern region's share of all Ontario employment. In S.I.C. 292, for example, the difference in these two percentages is 0.17 according to Table 4.5. In Northwestern Ontario there is only one specialization related to iron and steel -- the Fabricated Structural Metal Industry (302). The statistical analysis of Chapter Three demonstrates that other industries also have an affinity for locating near Iron and Steel Mills (291). These are the Metal Stamping, Pressing and Coating Industry (304), Wire and Wire Products Manufacturers (305), Hardware, Tool and Cutlery Manufacturers (306), Machine Shops (308) and Miscellaneous Metal Fabricating Industries (309).

Smelting and Refining (295) is even more established in the Northeast than are Iron and Steel Mills (291). From the Canadian input-output table 1971 it can be determined that this classification receives 96 per cent of the output of base metal and other metal mines. In terms of employment, Table 4.5 shows that Smelting and Refining (295) is the second largest employer in the Northeast and, according to Table 4.4, 46.5 per cent of Ontario employment in this classification can be found there. It plays no such role in Northwestern Ontario. Table 4.7 displays the percentage of sales to other industrial classifications originating from Smelting and Refining (295). This gives some indication of the later stages of processing

which depend on output of Smelting and Refining (295). In Northeastern Ontario none of these, with the exception of Copper and Copper Alloy Rolling, Casting and Extruding (297), ranks among the top twenty employers. The statistical analysis of Chapter Three indicates that the later stages of processing after Smelting and Refining (295) tend to be located in the market rather than near suppliers.

The export trade of the Northwest is therefore concentrated on ores and on the earliest stages of processing. Both the Northeast and the Northwest export iron ore, lead and zinc ores, but copper and nickel copper are exported from the Northwestern region only. The regional trade statistics shown in Table 4.3 indicate that there are exports at the stage of Smelting and Refining (295) and later stages of processing, but no breakdown of this is possible because the CFTM classification is not sufficiently refined. The production data of Table 4.5 suggest that very little trade beyond Smelting and Refining (295) could be expected.

Both Northeastern and Northwestern Ontario export iron ore but, as noted above, the basic industry, Iron and Steel Mills (291) is concentrated in the Northeast, which claimed 21.5 per cent of Ontario's employment in 1971. Nonetheless, the export trade of both regions has been augmented by products based on iron ore. According to Table 4.3, in the Northeast there is a net export of the more basic products (CFTM 71 which includes S.I.C. 291, 292 and some of 301-105) but there are net imports of more fabricated products (CFTM 75 excludes S.I.C. 291 and 292 but includes some of 301-305 and many others). The Northwest imports at the basic level (CFTM 71) and exports at the fabricated level (CFTM 75). This is because of the relative specialization in products which are part of such classifications as Shipbuilding and Repair (327), Railroad Rolling Stock (326), Aircraft and Aircraft Parts (321) and Fabricated Structural Metal Industry (302). On the whole, development through broadening the base of industries based on iron and steel seems more promising than forestry or non-ferrous metals.

Summary and conclusions relating to the Northwestern and Northeastern regions

As a generality it may be stated that manufacturing in the north is specialized. In only 11 out of the 110 industries listed in Table 4.5 is the

percentage of Ontario employment greater than the percentage of the Northwest's total employment in manufacturing. This is easily determined from inspection of the signs in the first column of Table 4.5. The difference between percentage employment in Dairy Products (104) and the percentage employment of all manufacturing is zero for this group, positive for those ranked 11 or less, and negative for those with higher ranking. In the Northeast there are only nine industrial classifications with positive rankings, while in the Toronto region there are 66, and in Kitchener/ Hamilton/St. Catharines there are 70. Trade figures reveal the extent of specialization outside manufacturing. The Northeast is a net importer of all categories of agricultural goods (CFTM 1-49) and energy. The Northwest is more balanced in agricultural trade but also imports all forms of energy.

The Northwestern region of Ontario is deficient in agricultural land suitable for farming, in energy, and in natural and man-made fibres necessary for primary textile production. Furthermore it lacks the population density necessary to attract firms operating at large scale, or those which locate to take advantage of economies of agglomeration. It has the lowest population density of all of Ontario's regions (1.11 per square mile in 1971), and few cities of any size. Thunder Bay is the only city above the Ontario median in population. While population growth may be an expected outcome of industrial development it is not likely ever to extend over the critical threshold where, as in Toronto, it becomes a positive locational force. Even though the population density of Northeastern Ontario is five times greater (5.24 per square mile) than that of the Northwest, similar comments must apply there. By contrast, the next most dense region, Lake Huron/Bruce, has a population density of 42.06. The largest city in the Northeast is Sudbury, which was smaller in 1971 than Thunder Bay. The economic advantage of the Northeast and Northwest derives from the abundance of certain resources, and these represent opportunities for development which can be achieved through expansion of the processing already existing, or through extension of the level of processing by introducing new products.

The north has established specializations at the earliest stages based on the abundance of forest products, and future development can be based on expansion at this stage. There is no specialization in production related to Wooden Box Factories (256) however. Since this industry is

among those poorly explained by city size and county density variables, it is recommended for further study. The locations of the remaining industries in this sector of the S.I.C. were determined either by the location of Construction or by city size and county density variables. Production in the north would need to be sold through special warehousing near the site of Construction. This arrangement might be considered in the case of the standard products represented by the output of Sash, Door and Other Millwork Plants (254), but it is unlikely to succeed in the industries which produce furniture of various kinds, and coffins.

In terms of the statistical analysis of Chapter Three, Iron and Steel Mills (291) offer the best prospects for development in the Northeast because, more than in any other industry, the technological relationship to other industries becomes a locational factor of significance. There is already some forward linkage from Iron and Steel Mills in the north, but nothing comparable has been developed in the Smelting and Refining (295) industry. Detailed microeconomic studies of the transportation costs and technological linkages of this industry should have a high priority in future developmental planning.

London and Lake Erie

The London/Lake Erie region is similar to Toronto in that services are its highest ranked specialization but, unlike the Toronto region, manufacturing as a whole employs a smaller percentage than the region's share of all employment. Consequently, there are many fewer specializations in the manufacturing sector (32 as compared with 66 for Toronto). Furthermore, the region's service industry is quite different. The percentage of employment in health welfare services in the London/Lake Erie region is greater than its regional share of employment by an amount which is larger than any other sector (see Table A4.3). Educational and related services rank third, and finance, insurance and real estate are fourth.

Table 4.2 documents the relative importance of agriculture in the London/Lake Erie region. The bottom portion compares the region with Ontario as a whole. 13.1 per cent of Ontario's agricultural workers are employed in this region. This is considerably greater than its share of fishery, mining, forestry or manufacturing employment (4.8, 0.9, 1.1 and 5.7 respecitvely). The specific form of this agricultural resource is also

clarified in Table 4.2. The percentage acreage committed to vegetables is 17.3 per cent of the Ontario total, the percentage acreage committed to field crops is 12.2, the percentage share of Ontario's value of livestock is 11.7, the percentage in fruit tree acreage is 6.1, and the percentage of small fruits acreage is 1.2.

Depsite the acreage committed to vegetables, there was no corresponding specialization in Fruit and Vegetable Processing Industries (103). Employment is 3 points less than the regional share of employment in manufacturing. This may be explained by the greater percentage of vegetable acreage in the Lake St. Clair region (34.4 per cent vs. 17.3 per cent) out of a smaller agriculture base (10.8 per cent of employment vs. 13.1 per cent) which might have shifted the processing of output west. Nevertheless, the production at the resource stage contributed to the trade of the region. There was a net export of fresh and frozen vegetables (CFTM 12) in 1975.

One of the specializations of the London/Lake Erie region is in the Flour and Breakfast Cereal Products Industry (105), which is ranked third in the region in the percentage of Ontario employed (29.9 per cent). This is unexpected because the percentage of Ontario's field crop acreage in both the Lake Huron/Bruce and the Eastern Ontario region is greater than London/Lake Erie, yet neither of these is specialized in the products of the Flour and Breakfast Cereal Products Industry (105). The statistical analysis of Chapter Three presents a possible explanation for this. Percentage employment in Bakery Products Industries (107) is a factor attracting firms in the Flour and Breakfast Cereal Products Industries (105). The Bakery Products Industries (107) themselves are located in counties which have larger cities (sizes I to IV) and which have a large percentage of the province's improved land acreage. The London/Lake Erie region is near the Kitchener-Toronto-Hamilton population centre and is land-abundant. To be located near the Bakery Products Industries (107) yet in regions with suitable land acreage, the firms in the Flour and Breakfast Cereal Products Industry (105) also locate in the London/Lake Erie region.

The Bakery Products Industries (107) group is also a specialization of the London/Lake Erie region. The statistical analysis of Chapter Three indicates that this can be explained by the presence of the Flour and Breakfast Cereal Products Industry (105). This is one of the cases where

the relationship between two industries is shown statistically to be mutually reinforcing. The Bakery Products Industries (107) specialization in the London/Lake Erie region can, therefore, be explained by the proximity of the region to the centre of Ontario and to the abundance of field crop acreage. The agricultural specialization is reflected in the regional trade figures of Table 4.3: Wheat (CFTM 6), Other Grains (CFTM 7), Wheat Flour (CFTM 8), Cereal Products (CFTM 9), and Oil Seeds (CFTM 19) are exported.

The two factors which explain Bakery Products also apply in the case of the Dairy Products Industry (104). The statistical analysis of Chapter Three shows that county density per se is not a factor influencing the location of the Dairy Products Industry (104), but city size variables (87,000 or more) are the factors which, together with improved land acreage, are significant. Such production, therefore, would be attracted to a region such as London/Lake Erie, which has a large share of the farm land and which is nearer the population centre of Ontario where most large cities are found. The region exports daily products (CFTM 5) and fresh and frozen meat (CFTM 2).

The region's specialization in products of the Feed Inudstry (106) may be related to the specialization in animals and dairy products, but the statistical analysis of Chapter Three confirms only that there is a significant relationship between the Feed Industry (106) and the percentage of improved land acreage in a county. Fodder and feed are regional exports (CFTM 15). Percentage of improved land acreage is not a factor explaining the specialization in the Beverage Industry (109). The county level statistical analysis suggests that it is influenced by county density and city sizes including size IV, which includes London.

A specialization based on Leaf Tobacco Processors (151) in London/Lake Erie cannot be explained by the percentage of acres of improved land. Only certain types of land are suitable for tobacco and, furthermore, Canada has control on tobacco production through acreage allotments. However, we note that 34 per cent of tobacco acreage is located in the London/Lake Erie region and it is not surprising, therefore, to find that the category Leaf Tobacco Processors (151) is ranked 6th among the region's specializations. The further stage of processing, Tobacco Products (153), is not established in the region but is shifted to the Toronto and Kitchener/Hamilton/St. Catharines regions. Although the input-output

table indicates that purchases from Leaf Tobacco Processors (151) is an important cost item for Tobacco Products, it did not turn out to be locationally significant. Tobacco is exported (CFTM 17) but unfortunately the regional trade statistics do not distinguish between the two stages of tobacco processing.

There are two textile specializations which have been established in London/Lake Erie even though the region lacks the statistically expected characteristics. Hosiery Mills (231) ranks second, and Knitting, Excluding Hosiery (239) ranks 12th. Generally the size of the largest city in the county is the predominant variable determining the location of firms in the clothing industry, and although Toronto city is statistically significant in all cases, occasionally small city sizes have some attractions. The percentage of employment in Knitting Mills (239) is best explained by a combination of percentage employment in Man-made Fibre, Yarn and Cloth Mills (183) and proximity to purchasing classifications represented by an aggregate called Clothing Principal Component. In short, proximity to both the supplier of intermediate goods required by Knitting Mills (239) and to the firms purchasing from Knitting Mills (239) is an important variable determining the location of the end-product clothing manufacturers: Men's Clothing Industries (243), which is not among the specializations of the London/ Lake Erie region.

A number of industries in the London/Lake Erie region are specialized in the non-metallic mineral products part of the Standard Industrial Classification. Cement Manufacturers (352) rank 18th and both Concrete Products Manufacturers (354) and Ready-Mix Concrete Manufacturers (355) employ more than the region's share of total manufacturing. Structural materials (sand, gravel and cement) are widely available in Ontario but costly to transport, and consequently most of the production occurs near the market in the south. There is a net export of sand and gravel (CFTM 39) from the London/Lake Erie region, but cement (CFTM 77) is imported. Production of cement is concentrated (Statistical Report on the Mineral Industry of Ontario, 1971-3, 256) in the Toronto region (Peel County) and Eastern Ontario (Hastings County). Nevertheless, London/Lake Erie is specialized in production of firms in the Cement Manufacturers (352), Concrete Products Manufacturers (354) and Ready-Mix Concrete (355) classifications. The statistical analysis of county level data in Chapter Three indicates that Ready-Mix Concrete (355) is located near Cement

Manufacturers (352) and that Cement Manufacturers (352) are located near Concrete Products Manufacturers (354). The latter relationship is reciprocal; the presence of Cement Manufacturers, but in conjunction with the presence of Construction, is a significant variable explaining the presence of Concrete Products Manufacturers. Employment in Cement Manufacturers (352) can be explained by employment in Concrete Products (354). London/Lake Erie is Ontario's largest exporter of non-metallic basic products (CFTM 78), which includes concrete. The evidence suggests that this specialization is due to proximity to Construction and to the available supply of sand and gravel, which is a substantial export (CFTM 39).

Lime Manufacturers (358) is the first ranked specialization in the London/Lake Erie region. The sedimentary calcareous rock needed to produce lime is widespread and hence the deposits which are developed are those nearest the market. The principal use in Ontario (Statistical Report of the Mineral Industry, 1971-3, 86) is for smelters and the iron and steel industry (38 per cent in 1971), and in manufacture of chemicals, fertilizers and insecticides (64.5 per cent in 1971). The developed deposits in Oxford county of the London/Lake Erie region constitute available supplies for use in the chemical industries of the Lake St. Clair region. Lime is part of the CFTM class 78, which is exported from the London/Lake Erie region.

The availability of lime and its use in fertilizer and insecticides helps to explain the 7th ranked specialization in the London/Lake Erie region. Statistical analysis indicates that the location of Manufacturers of Mixed Fertilizers (372) is explained by percentage of acres of improved land and employment in the Manufacturers of Industrial Chemicals (378) classification. Petroleum products are the largest cost items in production of industrial chemicals. Elgin and Oxford counties are two of four in Ontario which produce oil, but more significantly the region is near the major supply centre in Sarnia. It must be assumed that the specialization in Manufacturers of Mixed Fertilizers (372) is required to meet the local needs of agriculture, since the region is a net importer (CFTM 62).

The specialization in transportation in London/Lake Erie is part of the specialization of the three regions (including Lake St. Clair and Kitchener/Hamilton/St. Catharines) stretching from Buffalo on the east to Detroit on the west. The Railroad Rolling Stock Industry (326) ranks 8th, Truck Body and Trailer Manufacturers (324) is 9th ranked, and Motor Vehicle Manufacturers (323) ranks 30th as manufacturing specializations. In

searching for an explanation, the input-output and statistical analysis of Chapter Three was not helpful, but the trade figures confirm that London/ Lake Erie (as well as the Lake St. Clair and the Kitchener/Hamilton/St. Catharines regions) is an exporter (see Table 4.3, CFTM 83-87).

The remaining specializations in the London/Lake Erie region are unexpected in the sense that the characteristics of the industries (as indicated by the input-output relationships and the county level statistical results) do not match the characteristics of the regions. The results reported in Chapter Three show that percentage employment in Iron and Steel Mills (291) influences the location of Manufacturers of Major Appliances (332), which is the 11th ranked specialization of the London/ Lake Erie region, but Iron and Steel Mills (291) are a specialization of the Kitchener/Hamilton/St. Catharines region. The 14th ranked specialization is the Ornamental and Architectural Metal Industry (303); an examination of the costs of this classification of industry reveals it to be dependent on firms in the Iron and Steel Mills (291) classification, but the county level data revealed it to be among those market-oriented classifications attracted to larger cities which, except for London, are absent from London/Lake Erie region.

Statistical results would also lead us to look for the 22nd ranked specialization, Machinery and Equipment Manufacturers (315), in places specializing in Wholesale Trade, and to look for Commercial Refrigeration and Air Conditioning Equipment Manufacturers (316), ranked 19th, in Toronto city. An apparent inconsistency also arises in connection with the 10th ranked specialization, the Coffin and Casket Industry (258).

Summary and conclusions relating to the London and Lake Erie region

The manufacturing centre of Ontario does not extend into the London/Lake Erie region. Services, especially those relating to the government sector and agriculture, are relatively more significant and the latter provides commodity exports. Processing of vegetables and production of Tobacco Products (153) is less than would be expected. Like the Kitchener/ Hamilton/St. Catharines region, agriculture is influenced by the region's proximity to the population centre of Ontario, with specialization in dairy products, cereals and bakery products.

The specialization in Knitting Mills (239) is unexpected. Since the

county level data indicate that such employment is a factor attracting Men's Clothing Industries (243), this may be a means whereby such a category could be extended in London/Lake Erie.

As is true generally in regions bordering Lake Erie, the transportation industry has had a positive impact. What makes the region distinctive is the cluster of industries in the non-metallic mineral products grouping of the Standard Industrial Classification which provides commodity exports.

Lake Huron and Bruce, Central Ontario, Eastern Ontario

As one moves from the southern regions towards the three regions just north of the line drawn through London, Kitchener and Toronto, the population density drops considerably. The highest density, in Eastern Ontario is 77 per square mile, or about half that of the London/Lake Erie region, which is the least dense of the three regions to the south. Although Eastern Ontario is the most dense, one might expect that market-oriented industries would tend to locate in Central Ontario because it is located near Toronto and the other major cities of Ontario, in the centre of population density. However, the Ottawa-Hull area is a counterweight serving as a market for the Eastern Ontario region.

Lake Huron/Bruce, Central Ontario and Eastern Ontario form a wide border separating the two northern regions from the three southern regions and, because they share characteristics of both the north and the south, they are much less distinctive. In all three, the share of Ontario employment in agriculture ranks higher than fisheries, forestry or mining. The specific form of this agricultural abundance is indicated in the bottom of Table 4.2, which shows that these regions have a large share of Ontario's livestock and field crop acreage as compared to their share of other resources. Table 4.5 shows how much the agricultural base has been extended to later stages of processing. The Feed Industry (106) is one of the specializations common to all three regions. Statistical analysis of county data indicates that the percentage of agricultural acreage has a significant influence on a county's percentage employment in the Feed Industry (106). Dairy Products (104) is a second common specialization based on agriculture. Output of livestock combination farms provides the input needed for production of Dairy Products (104). The input-output

and statistical analysis of county data in Chapter Three indicates that a combination of two variables, percentage of improved land acreage and city size variables, explain the location of Dairy Products (104). According to Table 4.3, these are exported from all three regions, presumably to the larger cities in the Toronto and Kitchener/Hamilton/St. Catharines regions.

Only in Central Ontario do we find a specialization in the Flour and Breakfast Cereal Products Industry (105). This may be explained as follows: two locational variables, percentage employment in Bakery Products (107) and the percentage of Ontario improved land acres in a county, are significant in explaining the location of the Flour and Breakfast Cereal Products Industry (105). The percentage of improved land acres is large in all three regions, but the Central Ontario region shares a long common border with the Toronto region, which specializes in Bakery Products (107). Wheat flour (CFTM 8) and cereal products (CFTM 9) are exported from Central Ontario, presumably to the Toronto region. Production in support of this trade explains why the Flour and Breakfast Cereal Products Industry (105) constitutes the 8th highest ranking specialization in Central Ontario. Wheat flour (CFTM 8) is a common export of all three regions.

The specialization in Manufacturers of Mixed Fertilizers (372) found in the Lake Huron/Bruce region can be explained by two circumstances. One is related to the region's agricultural base. Statistical results derived from county level data show that the percentage of improved land acres is a significant variable explaining percentage employment in Manufacturers of Mixed Fertilizers (372). Secondly, the Lake Huron/Bruce region borders in the southwest on the Lake St. Clair region, which is specialized in Manufacture of Industrial Chemicals (378). This is also a significant variable explaining percentage employment in Manufacture of Mixed Fertilizers (372) at the county level. There is also a much lower ranked specialization in Manufacturers of Mixed Fertilizers (372) in Central Ontario but not in Eastern Ontario. It is probably better, therefore, to regard the specialization as a spill-over from the regions to the south, encouraged by the agricultural base in two of the three middle regions to the north.

In some categories resource comparisons and trade figures suggest specializations which have failed to develop. Despite the large shares of Canadian livestock present in the three regions, only in Lake Huron/Bruce do we find that the percentage employment in the Meat and Poultry Pro-

ducts Industries (101) is greater than the corresponding regional share of all manufacturing employment. All three regions are net importers of live animals (CFTM 1), but fresh and frozen meat (CFTM 2) is exported from the Lake Huron/Bruce and Central Ontario regions.

Except for pulpwood logs and chips, which are exported from Central and Eastern Ontario, all three regions import wood and wood products: logs and poles (CFTM 23), lumber and flooring (CFTM 52), plywood and veneer (CFTM 53), other fabricated wood products (CFTM 54), and wood pulp (CFTM 55). These categories are imported in all other southern regions of Ontario, and represent imports for the whole province. Many of them are specializations in the three regions under consideration in this section. Apparently none has succeeded in meeting competition from abroad, and it is correct to say that Ontario as a whole has failed to develop industries based on forestry products.

The involvement of Eastern Ontario in wood and wood products is restricted to the earlier stages of processing. Sawmills, Planing Mills and Shingle Mills (251) are ranked 8th and Veneer and Plywood Mills (252) ranked 11th as specilizations, but there are no other categories based on wood. This type of specialization is consistent with the resource base of the region. According to Table 4.2, the percentage of employment in Forestry is 11.5 percent which, except for the Northeastern and Northwestern regions, is the highest in Ontario.

Sawmills, Planing Mills and Shingle Mills (251) and Veneer and Plywood Mills (252) are also specializations in Central Ontario. In this region, however, there are several wood-based industries which extend processing to later stages: the Coffin and Casket Industry (258) is 7th ranked, the Miscellaneous Wood Industries (259) classification is 17th ranked, and the Office Furniture Manufacturers (264) classification is ranked 32nd. In the Lake Huron/Bruce region, there is no specialization in Veneer and Plywood Mills (252), but there are extensions to later stages of processing: Sash, Door and Other Millwood (254) ranks 7th, the Miscellaneous Wood Industries (259) classification ranks 5th, and in Household Furniture Manufacturers (261) one finds a category ranked first in order of specialization.

The earliest stages of processing in these classifications (S.I.C. 251, 252 and 259) are statistically explained in the county level data by Forestry employment, and for this reason represent specializations expected in the two northern regions and in Eastern Ontario where, indeed, they are

found. Otherwise, it must be assumed that these represent a continuity of northern characteristics over the northern portions of the three regions to the south. But the specialization of Lake Huron/Bruce in Household Furniture Manufacturers (261) appears out of place, since the statistical analysis at the county level indicates that the location of this industry is dominated by Toronto city. For similar reasons, the Coffin and Casket Industry (258) seems of out of place as a specialization for the Central Ontario region. The Sash, Door and Other Millwood Plants (254) classification is the 7th ranking specialization in Lake Huron/Bruce but, according to the statistical analysis, percentage employment in Construction, and county density, are the variables which explain such location. On the whole, one finds a statistical picture in which there are a number of industries shown in the county by county statistical analysis to be linked to Forestry resources or to city size variables, but which are specializations of the Lake Huron/Bruce, Central or Eastern Ontario regions that do not have these characteristics.

Most employment in the clothing industries is statistically related to city size or county density, and in only one region of the three under discussion do we find specialization of this kind. The second highest ranked specialization of Eastern Ontario is the Foundation Garment Industry (248); all other specializations are at the earlier stages. In Eastern Ontario employment in Man-made Fibre, Yarn and Cloth Mills (183) is first ranked in terms of its share of Ontario employment. Analysis of county level data indicates that there is no relationship to city size, county density, or prior to later stages of processing, but input-output data indicate that Manufacturers of Industrial Chemicals (378) provide the most important intermediate input (in terms of cost) to Manufacturers of Plastics and Synthetic Resins (373), which is also a specialization in the Eastern Ontario region. In fact, the county level and statistical analysis indicated that percentage employment in Manufacturers of Industrial Chemicals (378) is a significant variable explaining the location of Manufacturers of Plastics and Synthetic Resins (373). In short, the three industries are closely related; their simultaneous development in Eastern Ontario would be consistent with the locational patterns observed in Ontario as a whole, and would support the development of textiles in the region in so far as it can reduce costs in the Man-made Fibre, Yarn and Cloth Mills (183) industry. As an independent variable this last classification is statistically significant in

explaining the percentage employment in Knitting Mills (239), and input-output costs indicate that it is important to production in Hosiery Mills (231). Both of these are specializations of the adjacent Central Ontario region.

The Cotton Yarn and Cloth Mills (181) category is the 7th ranked specialization in Eastern Ontario, while Wool Yarn and Cloth Mills (182) is 12th ranked. In the statistical analysis of county level data it was determined that these would be found near clothing industries, which are not specializations of Eastern Ontario. As a hypothesis, it may be proposed that Eastern Ontario is providing the intermediate goods necessary for the Toronto specialization at the later stage. In this role, the region competes with the Kitchener/Hamilton/St. Catharines region, especially in Man-made Fibre, Yarn and Cloth Mills (183).

The connection to Toronto is also observable in Central Ontario which has two specializations, both of which could be regarded as filling in for specializations missing from the nearby Toronto region. Neither the Carpet, Mat and Rug Industry (186) nor the Automobile Fabric Accessories Industry (188) is a specialization of the Toronto region, but they are the only textile specializations of the Central Ontario region. Since county level data show that the location of the production is statistically explained by percentage employment in Motor Vehicles and Parts Manufacturers (323, 325), the specialization in Central Ontario seems again to be out of place. The Carpet, Mat and Rug Industry (186) also appears out of place, because it is related to Toronto city and county density with some propensity for city size 57,000 tp 81,000. Similar problems are encountered when we attempt to explain why Wool Yarn and Cloth Mills (182) are the second highest ranked industry in Lake Huron/Bruce.

As a related point, comment should be expressed concerning the establishment of production of leather goods in Lake Huron/Bruce. In all three regions whch specialize in leather goods there is also a specialization in Meat and Poultry Products (101). In the Toronto region the specialization is in Luggage, Handbags and Small Leather Goods Manufacturers (179), but the Lake Huron/Bruce and the Kitchener/Hamilton/St. Catharines regions specialize in all three categories: Shoe Factories (174), Leather Glove Factories (175), and Luggage, Handbags and Small Leather Goods Manufacturers (179). The statistical analysis of Chapter Three shows that Shoe Factories (174) and especially Luggage, Handbags and

Small Leather Goods Manufacturers (179), are market-oriented. Leather Glove Factories (175) are not well explained statistically, but percentage employment in Leather Tanneries (172) is significant.

There are only three lines of specialization relating to iron and steel. Wire and Wire Products (305) and Hardware, Tool and Cutlery Manufacturers (306) are specialization of Lake Huron/Bruce. The Miscellaneous Metal Fabricating Industries (309) is a specialization of Central Ontario. Percentage employment in Iron and Steel Mills (291) is a significant variable explaining location in each of these and, since none of the three regions is specialized in such production, the industries seem misplaced. The county level statistical analysis of Chapter Three makes the specialization in Hardware, Tool and Cutlery Manufacturers (306) in Central Ontario seem even more misplaced because typically it would be located in counties with large cities. The other two, Wire and Wire Products (305) and Miscellaneous Metal Fabricating Industries (309) are, ceteris paribus, attracted to counties with smaller cities. This is also true of Miscellaneous Machinery and Equipment Manufacturers (315), which is a specialization of both Lake Huron/Bruce and Central Ontario. On the whole, the pattern of location in these four is not consistent with that which is found in general as determined from county level data. One specialization in the Central Ontario region, Commercial Refrigeration and Air Conditioning Equipment Manufacturers (316), could not be explained by its proximity to suppliers or purchasers, by county density, or by size of city in county.

The broadest group of industries representing specializations of Central Ontario is that involved in shipbuilding and electrical products: Shipbuilding and Repair (327) ranks first, Miscellaneous Vehicle Manufacturers (329) second, and Manufacturers of Electrical Industrial Equipment (336) fourth. Manufacturers of Electric Wire and Cable (338) rank 9th, and Boatbuilding and Repair (328) is tenth in importance.

The Central Ontario specialization in Shipbuilding and Repair (327) and Boatbuilding and Repair (328) are shared with the Lake Huron/Bruce region. The former classification excludes boats under 5 tons. It is verified in Chapter Three that the availability of harbour services is of great importance to Shipbuilding and Repair (327), but not locationally important for Boatbuilding and Repair (328). The extensive shore line and recreational opportunities in these regions is no doubt a contributing factor in the location of the smaller boats covered by Boatbuilding and Repair

(328). Input-output evidence suggested that these facilities tended to locate near Truck Body and Trailer Manufacturers (324), but the statistical analysis did not give sufficient support to this hypothesis; nonetheless, it may be of some significance that Miscellaneous Vehicle Manufacturers (329) is the second largest employer in Central Ontario.

The specialization in electrical products in Central Ontario is shared with Eastern Ontario. Communications Equipment Manufacturers (335) ranks 5th in Eastern Ontario and 22nd in Central Ontario. Manufacturers of Electrical Industrial Equipment (336) ranks 4th in Central Ontario but is not a specialization in Eastern Ontario. Manufacturers of Electric Wire and Cable (338) ranks 6th in Eastern Ontario and ninth in Central Ontario. Miscellaneous Machinery and Equipment Manufacturers (315) are the 14th ranked specialization of Central Ontario, and the statistical analysis of county data shows it to be a variable explaining the location of Manufacturers of Electrical Industrial Equipment (336).

Trade figures provide some clues to the reason for the location of electrical production of Central and Eastern Ontario. The two regions border on the Toronto region; the earliest stage in the sequence is Smelting and Refining (295), which is located in Northeastern Ontario. According to regional trade figures, CFTM 74 is exported from the Northeast, and the Toronto and Kitchener/Hamilton/St. Catharines regions are the two principal importers. Later stages of processing, with the exception of Manufacturers of Electrical Industrial Equipment (336), are specializations of the Toronto region (see S.I.C. 329-339 in Table 4.5). The participation of Central Ontario and Eastern Ontario in these specializations is a carryover along the common border with the Toronto region. Table 3.8 shows that the electrical products members in the Standard Industrial Classification are locationally linked through many channels. The Communications Equipment Manufacturers (335) play a key role but S.I.C. 315, 334 and 336 are also locationally significant to at least one other industry.

Cement production in Ontario is concentrated in Peel and Hastings counties (Statistical Report on the Mineral Industry, 1971-3, 256). Hastings county is part of Eastern Ontario, and its role shows up statistically in Cement Manufacturers (352). This is the only specialization in the non-metallic mineral products industries in Eastern Ontario. Cement is exported in relatively large amounts (CFTM 77) from Eastern Ontario.

Smaller amounts exported from Lake Huron/Bruce and Central Ontario are indications that these regions also exploit this resource locally and, indeed, Cement Manufacturers (352) is a specialization in Lake Huron/Bruce according to Table 4.5. Results based on county level data in Chapter Three shows that percentage employment in Cement Manufacturers (352) is a locational factor attracting production of Concrete Products Manufacturers (354), but no such specialization has emerged in either Eastern Ontario or Lake Huron/Bruce. Construction is a second significant variable, but both regions are too distant from the centre of Ontario population for this variable to be effective.

The Central Ontario region is closer to the population density of Toronto and is, therefore, able to ship heavy materials at lower cost. It is, in fact, the principal exporter of sand and gravel (CFTM 39) and other mine products (CFTM 45) which include clay, abrasives and stone. The availability of supplies and the proximity to Toronto explain regional specialization in Stone Products Manufacturers (353), Ready-Mix Concrete (355), Glass and Glass Products Manufacturers (356) and in the Miscellaneous Non-Metallic Mineral Products Industries (359).

There were three industrial specializations which could not be explained, except in two cases, as possible spillover effects from other regions. The 5th ranking specialization of the Central Ontario region is Scientific and Professional Equipment Industries (391), which could be related to its proximity to Toronto; the specialization in Glass and Glass Products Manufacturers (356) in the Lake Huron/Bruce region could be related to its proximity to the Lake St. Clair region, because the Motor Vehicles and Parts Manufacturers (323, 325) in Lake St. Clair is a significant variable explaining the location of Glass and Glass Products Manufacturers (356). The input-output data and county level statistical analysis did not successfully explain the location of Clay Products Manufacturers (351) found in the Lake Huron/Bruce region.

Summary and conclusions relating to the Lake Huron and Bruce, Central Ontario and Eastern Ontario regions

Land suitable for agriculture is one of the features accounting for the industry and trade of the Lake Huron/Bruce, Central Ontario and Eastern Ontario regions. The production of feed and dairy products is common to

all three but, because it is closer to Toronto, Central Ontario is also specialized in flour and cereal production. Only Lake Huron/Bruce is specialized in fruit and vegetable processing, although all three are well endowed with suitable land. Also, Lake Huron/Bruce is the only region specialized in processing meat, despite the large share of Canadian livestock present in these regions.

Non-metallic mineral products have been developed because the Central Ontario region borders on the densely populated Toronto region, and because of the availability of structural materials and cement. The Eastern Ontario region's exports of cement can be explained by deposits in Hastings county.

There are a number of lines of specialization in these regions which would be statistically predicted from characteristics of bordering regions. The specialization in Mixed Fertilizers (372) found in the Lake Huron/ Bruce region is related to the production of Industrial Chemicals (378) in Lake St. Clair, and the specialization in Glass and Glass Products Manufacturers in Lake Huron/Bruce is related to Motor Vehicles and Parts Manufacturers (323, 325) in Lake St. Clair also. A similar hypothesis can be considered with regard to the specialzation in textiles in Eastern Ontario, which relates to the needs of the Toronto region's clothing producers. The output of electrical products in Central and Eastern Ontario can be regarded as complementary to the electrical industry in Toronto. Locations of other industries can be explained by their technological linkages.

The Eastern Ontario share of employment in Man-made Fibre, Yarn and Cloth Mills (183) was greater than its share in any other industry. This industry and a second specialization of the Eastern Ontario region, the Manufacturers of Plastics and Synthetic Resins (373), both depend on supplies of Industrial Chemicals (378). The three industries are closely related, and their simultaneous development in Eastern Ontario could become increasingly integrated, serving the needs of the Toronto region and the Knitting Mills (239) and Hosiery Mills (231) of the adjacent Central Ontario region as well. Similarly, the Central Ontario specialization in Communications Equipment Manufacturers (335), Manufacturers of Electrical Industrial Equipment (336) and Electric Wire and Cable (338) can be described in terms of interindustry relationships based on Toronto.

The specialization in the earlier stage of processing in Eastern Ontario can be explained by the region's abundance in forest products, but this

cannot explain the specialization in Lake Huron/Bruce or Central Ontario. There is difficulty also in accounting for the later stage processing of wood in Lake Huron/Bruce and Central Ontario because such production is market-oriented, and these two regions lie outside the centre of population. In wood products manufacturing generally, Ontario has failed to meet import competition.

The major characteristics explaining production in the central regions are the mineral deposits, the agricultural land mass, an extensive shoreline, and the influences of the Toronto and Lake St. Clair regions. The exports of cement from Eastern Ontario are explained by the deposits in Hastings county, but the influence of nearby regions is often observable. Non-metallic mineral products have been developed because the Central Ontario region borders on the densely populated Toronto region, and because of the availability of structural materials and cement. The proximity to the dense Toronto region and the abundance of agricultural land explains the specialization in feed and dairy products and, in the Central Ontario region, explains the specialization in flour and cereal production.

There are a number of lines of specialization in the central regions which would be expected in one of the bordering regions, and their presence appears to be induced from neighbouring regions. The specialization in Mixed Fertilizers (372) found in the the Lake Huron/Bruce region is related to the production of Industrial Chemicals (378) in Lake St. Clair, and the specialization in Glass and Glass Products Manufacturers in Lake Huron/Bruce is related to Motor Vehicles and Parts Manufacturers (323, 325) in Lake St. Clair also. A similar hypothesis can be considered with regard to the specialization in textiles in Eastern Ontario, which relates to the needs of the Toronto region's clothing producers. The output of electrical products in Central and Eastern Ontario can be regarded as complementary to the electrical industry of Toronto.

The Eastern Ontario share of employment in Man-made Fibre, Yarn and Cloth Mills (183) is greater than its share in any other industry. This industry and a second specialization of the Eastern Ontario region, the Manufacturers of Plastics and Synthetic Resins (373), both depend on supplies of Industrial Chemicals (378). The three industries are closely related, and their simultaneous development in Eastern Ontario could become increasingly integrated, serving the needs of the Toronto region

and the Knitting Mills (239) and Hosiery Mills (231) of the adjacent Central Ontario region as well. Similarly, the Central Ontario specialization in Communications Equipment Manufacturers (335), Manufacturers of Electrical Industrial Equipment (336) and Electric Wire and Cable (338) can be described in terms of interindustry relationships based on Toronto.

The central regions are specialized in the production of end products but have failed to meet import competition.

Concluding remarks

Toronto, Kitchener/Hamilton/St. Catharines, Lake St. Clair, the Northwestern and the Northeastern regions of Ontario are the most clearly identifiable in terms of their resource bases and population characteristics. Each has stabilizing features which account for their present development and will influence the direction of future growth.

The Toronto region is specialized in financial services. The manufacturing sector is forward linked to this sector. End stage manufacturing predominates over that at the earlier stages. Since there are no resources of significance, the export of services and the manufacturing of end-products is required to maintain the balance of trade. These functions are operationally essential to the continued prosperity of the region and are least likely to respond to decentralizing incentives. The industries which are involved were identified in the statistical analysis of Chapter Three. Policies which attempt to disperse the concentration of population work against that part of the manufacturing sector which requires the infrastructure, and economics of scale and agglomeration, to compete.

The Kitchener/Hamilton/St. Catharines region is specialized in production of intermediate goods at the earlier stages of processing. The region as a whole is, in this sense, forward linked to the provincial centre and, to achieve a balance of trade, is dependent on production and export at the earlier stage to finance imports of end-products. In securing this role, the Iron and Steel Mills (291) are the most important locational factor. The statistical analysis of Chapter Three demonstrated the propensity of this industry to encourage location of backward linked industries. The Motor Vehicles and Parts Manufacturers (323, 325) are also a significant locational factor in the Kitchener/Hamilton/St. Catharines region. A third factor is the agricultural base which supplies raw materials for processing.

While the agricultural base is a stabilizing influence, Motor Vehicle and Parts Manufacturers (323, 325) is a continuing cause for concern but, since Iron and Steel Mills (291) play an integral role in the region, any shift of the location of Motor Vehicles and Parts Manufacturers would have an adverse influence on employment of considerable long term significance.

Agriculture and the Motor Vehicles and Parts Manufacturers (323, 325) also are influential in establishing employment in the Lake St. Clair region. Distinguishing this region, however, are the industries based on Petroleum Refineries (365) and Chemicals (378) which were found to establish significant locational linkages.

The industries of the Northwest and Northeast are backward linked to forestry and metal ores. The remaining regions form an agricultural belt with production primarily influenced by the proximity of each to one of the other five.

Of the resources of Ontario there were two which demonstrated very little locational influence. Both could be important to northern development. Smelting and Refining (295) has not established forward linked industry in the north, and the forestry industry has established very little beyond the earliest stages of processing. The reason for this cannot be understood without in-depth microeconomic studies. Iron and Steel Mills (291) classification are already playing a central role in the Kitchener/Hamilton/St. Catharines region and, in fact, the development there has not been as much as is statistically expected. The role of Kitchener/Hamilton/St. Catharines as supplier of intermediate level goods would be adversely affected should the location of Iron and Steel Mills (291) shift to the north.

TABLE A4.1

Number employed in various Ontario sectors, 1971

	Sector	Number Employed	Percent
1.	All Industries	3 066 385	100.00
2.	Agriculture	123 465	4.01
3.	Forestry	8 300	0.27
4.	Fishing and Trapping	1 245	0.04
5.	Mines, Quarries and Oil Wells	40 055	1.30
	Manufacturing:		
6.	Total	804 910	26.16
	Food and Beverage	85 220	2.77
7.	Construction	197 185	6.41
	Transportation, Communication and other utilities:		
8.	Total	216 425	7.04
	Retail	124 420	4.04
	Trade:		
9.	Total	489 530	15.91
	Retail	357 090	11.61
10.	Finance	152 920	4.97
	Community, Business and Personal Services:		
11.	Total	770 820	25.06
	Education and Related	213 790	6.95
	Health and Welfare	192 550	6.26
	Personal	64 900	2.11
	Accommodation and Food	118 295	3.85
12.	Public Administration and Food	240 750	7.83
13.	Industries Unspecified	30 780	1.00

From Table 4, Statistics Canada (94-741, 1975)

Table A.42
Proportion of Ontario employment in each of nine regions - 14 aggregate sectors, 1971

S.I.C.	Name of Industry	Northwest Ontario	Northeast Ontario	Lake Huron/ Bruce	Central Ontario	Eastern Ontario	Toronto Region	Lake St. Clair	London/ Lake Erie	Kitchener/ Hamilton/ St. Catharines/
	All Industries	.026	.064	.029	.046	.140	.410	.062	.057	.166
1.	Total Manufacturing	.018	.042	.025	.041	.076	.442	.076	.052	.227
2.	Food and Beverage Manuf.	.014	.023	.039	.046	.093	.409	.093	.080	.204
3.	Construction	.028	.075	.031	.052	.137	.403	.059	.053	.162
4.	Total Transp. Communic. Util.	.047	.077	.024	.036	.130	.460	.056	.050	.120
5.	Transportation and Storage	.063	.090	.020	.032	.109	.457	.056	.052	.121
6.	Total Trade	.025	.056	.025	.048	.119	.458	.062	.055	.153
7.	Retail Trade	.026	.061	.026	.051	.129	.425	.066	.055	.160
8.	Finance, Insurance, Real Est.	.013	.032	.015	.029	.107	.573	.042	.063	.126
9.	Total Service Industries	.028	.060	.024	.048	.147	.413	.059	.061	.160
10.	Education and Related Services	.027	.068	.020	.041	.164	.372	.060	.064	.183
11.	Health and Welfare Services	.032	.060	.030	.056	.151	.371	.058	.081	.162
12.	Personal Services	.024	.055	.029	.049	.143	.407	.068	.060	.165
13.	Accommodation & Food Service	.047	.089	.026	.069	.130	.367	.070	.046	.156
14.	Public Admin., Defence	.024	.062	.015	.047	.408	.290	.033	.039	.081

SOURCE: Census of Canada (1971, 94-741, Table 4)

Table A.43
Proportion of employment in specific industries in each Ontario region compared to proportion of total employment in each region - 14 aggregate sectors, 1971

S.I.C.	Name of Industry	Northwest Ontario	Northeast Ontario	Lake Huron/ Bruce	Central Ontario	Eastern Ontario	Toronto Region	Lake St. Clair	London/ Lake Erie	Kitchener/ Hamilton/ St. Catharines
1.	Total Manufacturing	-.009(12)	-.022(12)	-.004(7)	-.005(10)	-.063(14)	.031(5)	.014(2)	-.005(10)	.062(1)
2.	Food and Beverage Manf.	-.012(13)	-.041(14)	.010(1)	-.001(9)	-.047(13)	-.001(8)	.031(1)	.023(2)	.038(2)
3.	Construction	.001(6)	.011(4)	.033(2)	.005(3)	-.003(6)	-.007(10)	-.003(8)	-.004(9)	-.004(6)
4.	Total Transp. Commmnic. Util.	.021(2)	.013(3)	-.005(10)	-.010(12)	-.010(8)	0.49(2)	-.006(11)	-.007(12)	-.046(13)
5.	Transportation & Storage	.036(1)	.026(1)	-.009(12)	-.014(13)	-.031(11)	.047(4)	-.006(12)	-.005(11)	-.044(12)
6.	Total Trade	-.002(9)	-.008(10)	-.004(8)	.002(7)	-.021(10)	.048(3)	-.000(6)	-.002(8)	-.013(10)
7.	Retail Trade	-.000(8)	-.003(7)	-.003(6)	.005(4)	-.010(9)	.015(6)	.004(5)	-.001(7)	-.006(7)
8.	Finance, Insurance, Real Est.	-.013(4)	-.032(13)	-.013(14)	-.017(14)	-.032(12)	.163(1)	-.020(13)	.006(4)	-.040(11)
9.	Total Service Industries	.002(5)	-.004(8)	-.005(9)	.002(6)	.007(4)	.002(7)	-.003(9)	.004(5)	-.006(8)
10.	Education and Related Services	.001(7)	.004(5)	-.008(11)	-.005(11)	.024(2)	-.038(11)	-.002(7)	.007(3)	.017(3)
11.	Health and Welfare Services	.005(4)	-.004(9)	.001(3)	.010(2)	.011(3)	-.039(12)	-.004(10)	.024(1)	-.004(5)
12.	Personal Services	-.002(11)	-.009(11)	.000(4)	.002(5)	.004(5)	-.003(9)	.006(4)	.003(6)	-.001(4)
13.	Accommodation and Food Services	.020(3)	.025(2)	-.002(5)	.023(1)	-.010(7)	-.044(13)	.008(3)	-.011(13)	-.010(9)
14.	Public Admin., Defence	-.002(10)	-.002(6)	-.013(13)	.001(8)	.268) 1)	-.120(14)	-.029(14)	-.018(14)	-.084(14)

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